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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS,

Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 31.

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They are heavy, rigid machines, making a smooth cut. No chattering.

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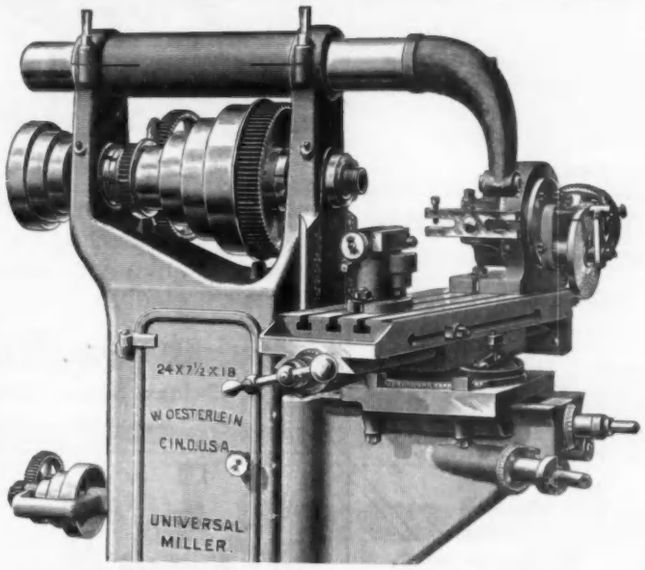

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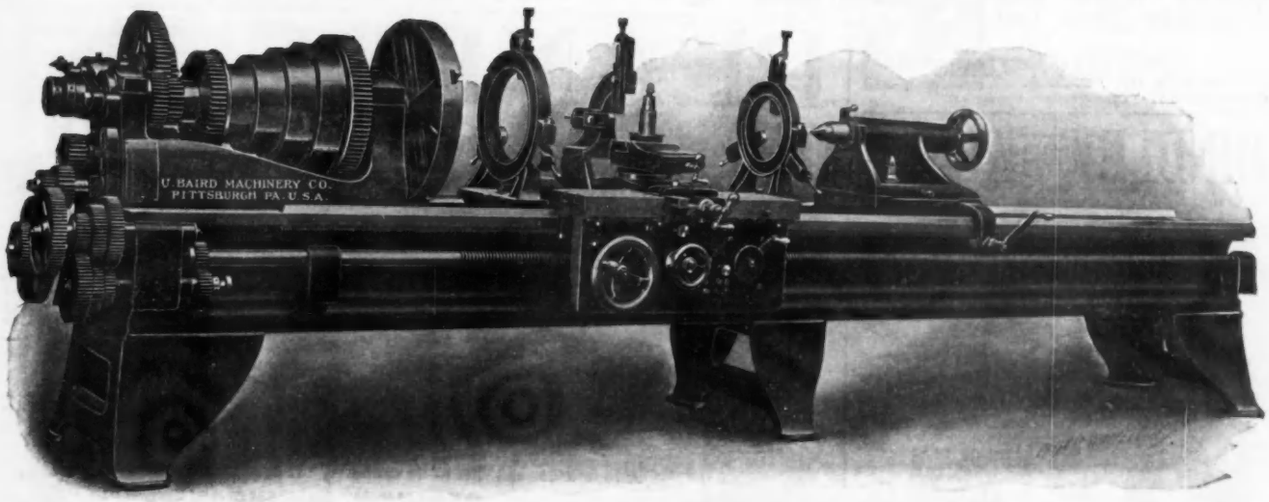

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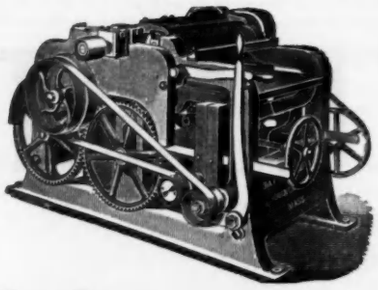

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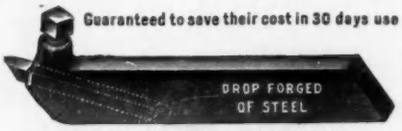

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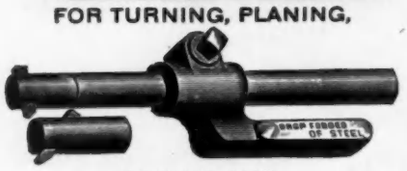

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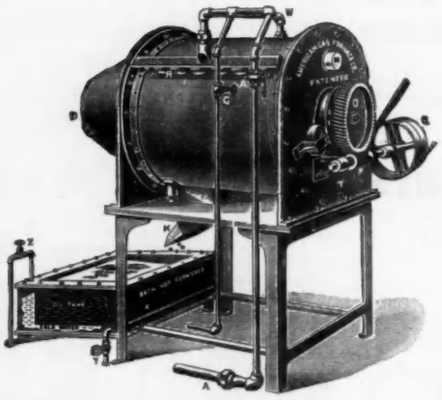

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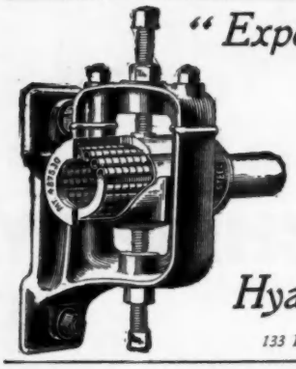

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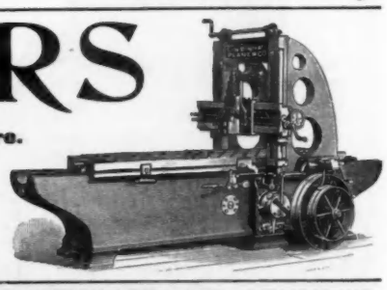

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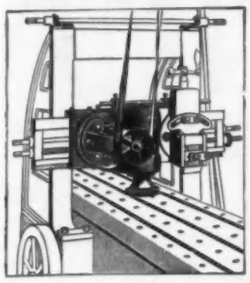

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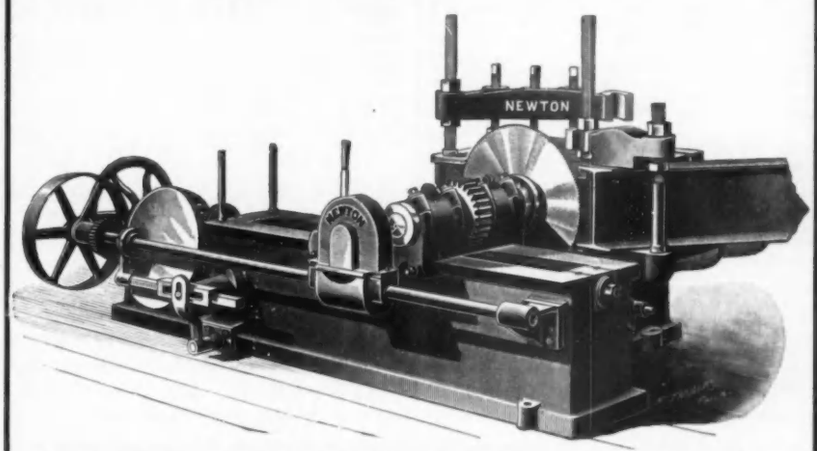

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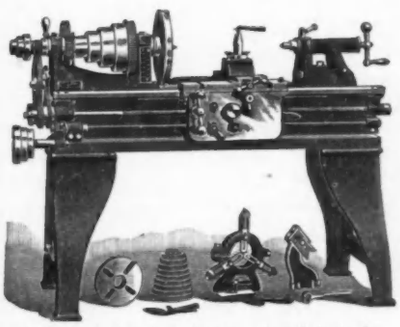

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AMERICAN MACHINIST

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Notice.

Mr. C. P. Day is no longer the Eastern representative of the "American Machinist," nor is he in any way connected with it or the American Machinist Press. The name of Mr. Day's successor will be announced in an early issue. All mail intended for the "American Machinist" should be addressed to 218 William street, New York. We have no office or representative at 95 Liberty street.

AMERICAN MACHINIST PRESS.

The Friction of Compressed Air in Pipes.

There are not many common problems in engineering practice in which pure guess-work is resorted to in so large a proportion of cases as in the determination of the sizes of pipes to carry compressed air. To begin with, not many, comparatively speaking, are acquainted with the necessary formula, and still fewer have any knowledge of the value of the constants to be used, while at best the formula is one of those which most people desire to shun as much as possible.

When the serious and continuing nature of the loss, if the pipe is too small, or the equally serious magnitude of the increased cost of a long pipe line if the pipe is too large, is considered, it will be seen that better practice should prevail, and we hence regard the article of Mr. Johnson's published last week as a notable contribution to practical engineering literature.

Owing to the fact that the loss of pressure varies much more rapidly than the size of the pipe, the correct size is usually a pretty definite thing, and the calculations give a corresponding degree of satisfaction when finished. The engineer who has these calculations to make will seldom find more than two sizes of pipe economically possible under a given set of conditions. It frequently happens that a reduction in the diameter by a single inch from one giving a satisfactory result, will send the loss up to a figure which no one would tolerate for a moment. This condition of things increases the danger due to guess-work and adds a corresponding value to calculated results.

It will be seen that Mr. Johnson develops an original formula, though one which is, we believe, identical with one recently developed by Professor Church, of Cornell University, which is strictly rational, and does not, like those in common use, do violence to the proprieties by ignoring the change of volume and velocity due to change in pressure. While the error due to the old formulas is not usually large within the limits of most power-transmission plants, it is always on the unsafe side, and for a considerable percentage of cases the old formula is not properly applicable at all.

Not only does this article give an analytically correct formula applicable to all conditions, but it gives in the diagramatic form a ready solution to the formula, and so adds another to the already long list of useful diagrams which have of late formed a feature of our pages. With the problem in this shape, there is no longer any excuse for guess-work in connection with it.

The Premium Plan in Europe.

"Engineering," of London, devotes its leading three-column editorial for July 14 to a consideration of the premium plan. After a discussion of piece work and its difficulties, from which it appears that these difficulties are much the same in England as here, it goes on to say:

"A very interesting attempt to turn the difficulties in the payment of labor is the 'premium plan,' to which we have many times referred in 'Engineering,' the last occasion being in our issue of April 21 last."

Following this is an appreciative description of the principles and application of the system, including a reprint of the chief table of results published in our issue of March 9. With the industrial awakening now in progress in England and the attention which American methods are attracting there, we shall be surprised if the system does not gain a foothold in that country. In fact, American manufacturers should understand the shaking-up process which has resulted from their own forward movement in the export trade, and should realize that it is not always a promising spurt at the start which wins a race.

It will also interest our readers to know that one of the leading engine-building firms of continental Europe has informed us of its intention to make a trial of the system, and that a leading continental electrical works has already commenced its use.

Chinese Engineering Works.

Most prominent among the Chinese engineering establishments are the iron and steel works at Hanyang, the rifle and gun factories at the same place, the arsenals of Tientsin, Shanghai (Kiangnan arsenal), Footchow and Canton, and the machine and car works belonging to the administration of the North Chinese State Railways at Tonaschan, which have recently erected an establishment for the construction of bridges and constructional work.

Unfortunately, most of these modern factories, equipped with the latest and most improved machinery and tools, are to a large extent being neglected and almost ruined by the Chinamen in charge of the works. A fact best illustrating this is shown by the iron and steel works of Hanyang, which are the property of Sheng Toatai, the same Chinaman who is at the head of the construction works of the great Chinese railway line, Peking-Han-kan-Canton. This establishment, after having been equipped with blast furnaces and all modern machinery from Great Britain, Germany and the United States, was first superintended by English, Belgian, French and German engineers, who, however, scarcely having begun to run the works after modern ideas, were discharged one after another by the owner, the Viceroy of Wutchang, and later on

by the above mentioned Toatai, for the reason, as they were told, that the Chinese engineers and workmen employed at the works would be able to run the different shops alone. The true reason of this step, however, was to get rid of the Europeans. As a result of these changes in the administration of these works, and their almost entire transfer into the hands of Chinamen, the production fell off enormously in 1897 in spite of very favorable circumstances.

Under these conditions it is not probable that this establishment will be in a position to turn out the material required for the construction of the Chinese State Railway. Already the first attempts in this direction have proved a failure, in as far as the rails supplied by the works of Hanyang in 1898 for the railway line Shanghai-Wusung proved to be absolutely useless. They had to be immediately replaced by rails imported from Belgium.

The same mismanagement prevails among the gun factories and the other establishments of the Chinese army and navy administration, which, under the superintendence of mandarins, are reported to be in a state of the greatest disorder and producing almost nothing. Thus, for instance, the output of the rifle factory of the Kiangnan arsenal, in which more than 600 workmen are employed, amounts at the most to *one* rifle per day! The shipbuilding yards of the Chinese Navy Department are almost entirely out of work and confined to unimportant repairs of Chinese war vessels.

The sole exception is presented by the Arsenal of Footchow, on the southeast coast of China, which in former years was managed by French engineers. By a special contract between China and the French Government in 1897, a further number of French engineers was secured for these works. These foreign engineers have been instructed to not only increase the capacity of the arsenal by enlarging the different shops and the working of mineral deposits in the surrounding districts, but also to superintend the construction of several men-of-war for the Chinese Government. In connection with the prolongation of the North Chinese State Railways, to Peking on the one hand and to Shanghai on the other, the repair shops of these railways have largely been extended and new machine and car works erected, in which almost all passenger and freight cars, as well as other railway material for the same railways, are now being built. Only a few parts of minor importance, such as axles, tires, springs, etc., are still imported. The construction of a palace car for the Empress of China, in which her Majesty intends to travel in the near future from Peking to Tientsin and Peitapo, shows the great efficiency of this establishment, which, by the way, is under the general superintendence of a British chief engineer. Only locomotive engines are imported from abroad and erected in the different shops of this establishment. The imports of foreign machinery into China are increasing. In 1898 our leading exports to that country consisted of the following items:

Machine tools	$ 19,488
Pumps and pumping machinery	5,265
Locomotives	121,000
Boilers	12,404
Unspecified machinery	84,053

A strange feature in our last year's Asiatic machinery export trade was that our shipments of machine tools to Japan, by far the most progressive of all the East Asiatic countries, amounted only to a value of $10,077, while those to China were valued at $19,488. In electrical machinery, however, Japan took $165,398 worth, while our exports to China amounted to only $1,868. H. L. G.

Society for the Promotion of Engineering Education.

The seventh annual meeting of the above named society will be held at Columbus, Ohio, August 17, 18 and 19. The sessions are to be held in Townshend Hall, Ohio State University. Below we give a list of papers which are to be presented on this occasion.

Thursday Morning, August 17.—Address by the president, Thomas C. Mendenhall, president Worcester Polytechnic Institute; "The Essentials of a Technical Education," A. L. Rice, professor of steam engineering and electricity, Pratt Institute; "The Engineering Educational Value of a Refrigerating Plant," William T. Magruder, professor of mechanical engineering, Ohio State University.

Thursday Afternoon, August 17.—"The Place of Correspondence Schools in Engineering Education," Edgar Marburg, professor of civil engineering, University of Pennsylvania; "Advanced Algebra in Engineering and Other College Courses," F. L. Emory, professor of mechanics and applied mathematics, University of West Virginia; "Hydrocarbon Engine Testing Plant of the Ohio State University," William T. Magruder, professor of mechanical engineering, Ohio State University.

Friday Morning, August 18.—"Teaching Force Assigned per Student in the Several Divisions of a Technical College," J. P. Jackson, professor of electrical engineering, Pennsylvania State College; "Methods of Teaching: By Text-Book, by Lectures, by Laboratory, by Design, by Memoir," C. F. Allen, professor of railroad engineering, Massachusetts Institute of Technology; "A Catalogue and Clipping Case," William T. Magruder, professor of mechanical engineering, Ohio State University; "Engineering Education and Expansion," W. S. Aldrich, professor of electrical engineering, University of Illinois.

Friday Afternoon, August 18.—"A Convenient Laboratory Equipment for the Study of Direct-Current Dynamos and Motors," H. B. Smith, professor of electrical engineering, Worcester Polytechnic Institute; "A Comparative Study of the Electrical Engineering Courses Given in Different Institutions," F. C. Caldwell, associate professor of electrical engineering, Ohio State University; "An Apprentice System in College Shops," O. P. Hood, professor of mechanical and electrical engineering, Michigan College of Mines; "Drawing, Mechanical Laboratory Practice and Shop Work in Engineering Colleges," H. E. Smith, assistant professor of mechanical engineering, University of Minnesota.

Saturday Morning, August 19.—"The Desirability of Uniformity in the Use of Mathematical Symbols and Terms," A. E. Haynes, professor of mathematics, University of Minnesota; "The Use of Graphical Methods in the Solution of Problems in Mechanics," C. M. Woodward, professor of applied mechanics, Washington University; "On the Nature of Entropy," Albert Kingsbury, professor of mechanical engineering, New Hampshire College.

The chief engineer of the Manchester (England) Steam Users' Association, in the conclusion of a paper upon "The Selection of a Boiler," says that, "generally speaking, the simplest comparison which can be made before deciding on a boiler is to add together the interest on the first cost of the boiler and housing, the ground rent, coal and attendance, and to divide this sum by the amount of water to be evaporated."

A press item announces that Mr. John A. Brashear, of Allegheny City, is soon to commence work on a telescopic objective of 32-inch aperture for a new telescope to be erected at Allegheny Observatory. It is said that Mr. Brashear expects to spend most of the coming winter on the work, and it is believed that this lens when finished will be at least not inferior to any other in existence.

A copper company of this city has recently received from India 250 tons of copper coins. They are imported as copper scrap, and at the present price of copper the metal is worth more than the money value of the coin. With copper at 10 cents per pound there was profit in coining for the Indian Government; but with copper at 18½ cents the profit is the other way.

The grave of a blacksmith at Belleville, Ill., is surmounted by a large anvil, upon which the deceased had worked for thirty-five years. Above the anvil is a mammoth horseshoe with the name and age inscribed upon it. The whole has been covered with a white enamel for protection.

Commercial Review.

NEW YORK, SATURDAY EVENING,
July 29, 1899.

STEAM POWER PLANTS.

The engine market is thinly spattered with summer dullness. On the whole it is as busy as it need to be, or more so, and the conditions of congested shops and strengthening prices show no reaction. July has seen a continuation of the upward movement in values.

The boiler contract for the new power plant of the Manhattan Elevated Railway has been awarded. The installation will comprise 32,000 horse-power of Babcock & Wilcox boilers in 500 horse-power units. A contract was also let for Roney mechanical stokers.

It is stated by Mr. Baker, engineer of the equipment of the road, that the 8,000 horse-power Allis engines, the award of the contract for which we announced two weeks ago, will probably be running within ten months. This is a matter of no small surprise, in view of the length of deliveries generally named on large machinery. Two years' time for delivery would have come nearer to general expectations. Perhaps, therefore, the installation will be made in installments and some of the engines put in later. The preparations for the letting of contracts for the electrical machinery for the plant are stated to be progressing satisfactorily, but not yet to have reached any point requiring specific mention.

For one of the best-known engine-building companies the following statement as to deliveries is made: "Our time for the delivery of an engine of 500 to 1,000 horse-power would be from four to seven months. We could now name a delivery of four months on a 500 horse-power engine, but probably we could not do as well sixty days hence, for indications are that deliveries will grow longer. We are selling engines faster than we can build them, and the large stock of small engines which we had on hand when the revival set in is becoming depleted."

Quite an unexpected light is cast upon this year's engineering situation by the spokesman for an important engineering firm. He states that the amount of constructive work now going on is really less than last year. This is confessedly anomalous when the extreme difficulty in obtaining supplies is taken into consideration. It is intimated that the shape mills and others are refusing orders for the sake of keeping up prices. If you are willing to pay for it, you can get material for almost immediate delivery.

The last-mentioned circumstance is notorious. But the idea that the overcrowded condition of the mills—plate mills, at least—is not *bona fide* is flatly contradicted. The manager of the New York office of a prominent Western boiler company states that almost or quite every plate mill in the country is sold out for a year ahead. His own company has a standing contract for material, and consequently its wants are deferred to those of other buyers who are willing to pay a bonus for quick shipment.

Terms of sale which have been named by a certain large wrought-iron pipe company are said to be as follows: "Deliveries at our option, price to be made on day of delivery." Why the company does not ask for an immediate assignment over of all lands, goods and chattels of the purchasers we fail to perceive.

Electrical distribution of power from central stations to gold mining plants is proposed at several points in Australia, and the syndicates controling them have looked to this country for the installation. There would be considerable gain in the plan, as more economical plants could be installed than the isolated ones now in use. Moreover, the aggregate power would not have to be as great as under the present system, since the hoists of the various mines would not all be in operation simultaneously. This would render 7,000 horse-power a sufficient allowance where 10,000 would otherwise be required. In these central plants the power will be generated by steam, as may well be inferred from the fact that at the point where one of them may be located there are at present arrangements for pumping feed water twenty miles. Coal, however, is expensive, costing at one of the plants $7.50 a ton. This is naturally an inducement to the installation of the most economical system for its use. The first of these plants will be of 6,000 horse-power, and bids have already been asked for three 1,500 horse-power engines. Another plant will be of 2,000 horse-power at the start, and a third, if it is put in, will be of about the same size.

A distinct victory for the gasoline engine against the steam engine seems to lie in the order for five 90 horse-power, direct-connected Westinghouse gas engines for lighting purposes, purchased for the Florida East Coast Hotel system (a Flagler interest). The order was given out as the result of competitive trials of steam and gas engines in the hotels of the system. There are already installed three Westinghouse gasoline engines of 50 or 75 horse-power each, and these are stated to have been found as reliable, free from danger of breakdown, as steady in operation of lights and more economical than the steam plants.

In the new Riter & Conley plant, Pittsburgh, natural gas power will be used, and two 125 horse-power Westinghouse engines have thus far been ordered.

MISCELLANEOUS.

Such reports of the state of affairs in the machine-tool trade as have been heard in this quarter within the last week or two have been buoyantly cheerful and indicate that the companies concerned are not affected appreciably by the hot weather. The Niles and Pond office, New York, is deeper in business than ever.

The L. S. Starrett Company, Athol, Mass., having found that its entire factory and energies are needed for the continuance of its fine tool business, has sold out the stock, machinery and good-will of the department of milling cutters, etc., to Mr. F. J. Gay, for the last five years a partner and manager in this branch, together with Mr. E. T. Ward. That line will therefore be carried on henceforward by the firm Gay & Ward, Athol, Mass.

The Landis Tool Company, Waynesboro, Pa., will extend their new shop 120 feet, making it 200 feet long over all. They report business very good.

The Hyatt Roller Bearing Company has taken contracts to equip with shafting, hangers and boxes the addition to the shop of the Bullard Machine Tool Company, Bridgeport, and the new Edison incandescent lamp factory, Harrison, N. J.

The Builders Iron Foundry and Diamond Machine Company, Providence, R. I., have advanced prices on grinding machines about 10 per cent.

The Gold Car Heating Company, New York, and the Gold Street Car Heating Company have received orders within the last few months which surpass all their former records. Prominent among recent contracts of the Gold Car Heating Company is one from the Boston Elevated Railway Company for electric heaters for 100 new cars.

As a result of experiments with automobiles for the collection of the mails in Buffalo, it is predicted that the Post Office Department will become a large purchaser of these vehicles.

Mr. Frank M. Pierce, president of the Frank M. Pierce Engineering Company, engineers of steam power and electric plants, expects to make a business trip to the Philippines, starting about the first of the year. In the meantime he will go to Europe and back. Mr. Pierce has lately returned from an extended tour through the West, taking in the Pacific Coast, from San Diego to Vancouver. He observes that Western business improvement is in advance of the Eastern, which may be explained from the fact that capital is scarce there, and its holders cannot afford to wait as long for its investment as they do here. Conditions at home Mr. Pierce found upon his return to be decidedly better than they were four months ago. Information he has received of matters in Cuba does not indicate that immediate opportunities for engineering work are better throughout that island, generally, than they were at the time of his visit to it last winter.

PITTSBURGH REPORT.

There is a quietness prevailing in the iron and steel trade which is firmly believed to be a calm before a storm. A very substantial advance in prices can be

looked for, from the raw pig down to the finished material. It has been the case for some time past that quotations are merely nominal simply because no material can be had for immediate or future delivery this year. In all quarters it is firmly believed that Bessemer pig iron, which has been selling at $20 per ton in the valleys, will again be advanced.

The main drawback in the present boom, and the only thing which makes manufacturers feel sad is the fact that most of the business done in the past six or eight months was on old contracts which called for exceedingly low prices. It is surprising to know the amount of orders taken during the early part of the year, when raw material was low and mills were in fair running order. The people that are booking orders to-day at prevailing prices, and are able to fill the same, are the ones who are getting the good out of the market. When the outlook for higher prices on foundry and other grades of iron began to grow bright many took the tide on the flood and laid by a large amount of material. But there were numerous ones who did not, and they now suffer from the state of the market.

As far as general machinery is concerned, the Pittsburgh district is asking for more than its share. There has not been such a demand for material for some years past as there has been for the last month or so. Mills are constantly asking for engines, boilers, heaters, new devices for rolling mills, etc. The Bass Foundry & Machine Company, Fort Wayne, Ind., has had a representative here for some time past, and he has contracted for heavy rolling-mill engines for the New Pittsburgh Steel Hoop Company, which will erect a plant at Glassport, Pa., and make hoops in competition with the hoop combination. Contracts were also taken to furnish heavy Corliss engines to the W. Dewees Wood Company, McKeesport, Pa.; Whittaker Iron Company, Wheeling, W. Va.; Tyler Tube & Pipe Company, Washington, Pa., and others. James Bonar & Co., of this city, who are agents for the sale of the Pittsburgh feed-water heater and purifier, have made several large sales within the past few weeks. In fact, all the steam specialty concerns have their hands full attending to inquiries.

In the rolling-mill machinery line, the Mesta Machine Company has lately equipped several large mills, notably those for the Illinois Steel Company, and has orders on the books to keep the plant busy for some time to come. The Totten & Hogg Iron & Steel Foundry Company and the Frank-Kneeland Machine Company are running their plants to full capacity.

As far as new establishments are concerned, there are several under contemplation. A cold rolled steel shafting plant is to be erected at Rankin station, near this city, by Thos. W. Fitch, Jr., of Braddock. Plans are now being prepared for the buildings, etc., but the contract for the machinery has already been awarded to the Brightman Manufacturing Company, Millersburg, O. The Monongahela Tube Company has given contracts for the necessary furnaces and machinery for equipping its new lap weld tube plant. The Morris & Bailey Steel Company has under course of construction a large addition to its plant for the manufacture of cold rolled steel, while Jones & Laughlins have started work on an addition, 400x150 feet, to their shafting plant.

CHICAGO MACHINERY MARKET.

It is common belief here that the sales of engines and boilers since January 1 have exceeded in horse-power the business of any previous twelve months in the history of the country. With the annual record thus broken in little more than six months, the aggregate for the year must show a most decided gain over any past comparisons. But it is not expected that activity will continue through the remainder of the year as great as during the past month or two. Inquiries and sales during the latter period have been almost marvelous in their volume. Among the recent large purchasers of power have been the large iron and steel companies, organized early in the year by the consolidation of divers smaller concerns. They have, with possibly one exception, been arranging for a largely increased capacity, the deliveries of engines and boilers extending into next year. The purpose, as indicated by these large purchases, is to get the largest possible output from the plant controlled. The Federal Steel Company, the National Steel Company, the American Steel & Wire Company and the Carnegie Steel Company have all been generous buyers of power. The total purchases of this nature have doubtless exceeded $1,000,000 during the past few weeks, possibly exceeding that amount considerably. Blowing engines to the value of $250,000 have been sold by one Western maker alone during the past few weeks to the iron and steel companies.

With the builders so well provided with work, it matters little from the producing standpoint whether or not additional orders are taken during the balance of the year. Activity is assured in any event. But besides this special spurt in the big steel trade the demand from miscellaneous sources is large. The universal report is that builders are behind in their orders. Moreover, they have not gained appreciably during the month of July, which is supposed to be one of dullness. Prices of both engines and boilers have advanced, making on some products the third rise in three months. With prices of material continuing to advance, the prospects are for even higher prices of power. If demand continues so brisk as now a further marking up of prices is almost inevitable. The makers of the smaller engines are not sold so far into the future as the large Corliss works, but even with the former, prosperity has leased apartments for months ahead. It is noticeable also that the usual territorial lines have become obliterated. All makers are making new conquests, and not a few are invading foreign lands to a degree surprising to themselves.

The Aultman & Taylor Company, Mansfield, Ohio, has recently added a new furnace and foundry to its plant, increasing the capacity three-fold. It is building a 160-foot extension to the boiler works, which will add about 50 per cent. to the previous floor space. The company has purchased a large number of riveting machines and other equipment and by October 1 will have increased its producing capacity 100 per cent.

The E. P. Allis Company is increasing the capacity of its plant at Milwaukee by various additions and improvements. Among its recent large sales were blowing engines for Newfoundland and Russia, besides many for use in this country.

Quotations.

NEW YORK, Monday, July 31.

Iron — American pig, tidewater delivery:—

Pennsylvania irons:	
No. 1 X foundry	$20 60 @ 21 50
No. 2 X foundry	19 60 @ 20 50
No. 2 plain	18 60 @ 20 00
Alabama irons:	
No. 1 foundry	20 25 @ 20 75
No. 2 foundry	19 25 @ 19 75
No. 3 foundry	18 50 @ 19 00
No. 1 soft	20 25 @ 20 75
No. 2 soft	19 25 @ 19 75
Foundry forge	18 00 @ 18 50

Bar Iron — Base sizes—Refined, from mill, 2.10 @ 2.20c., on dock; refined, from store, 2.40 @ 2.45c.; common, from store, 2.30c.

Tool Steel — Base sizes — Standard quality, 6½ @ 8½c.; extra grades, 12 @ 14c.; special grades, 16c., and upward.

Machinery Steel—Base sizes—Ordinary brands, from store, in small lots, 2.60c.

Cold Rolled Steel Shafting—Base sizes—From store, in small lots, 3½ @ 3¾c.

Copper—Carload lots, Lake Superior ingot, 18½ @ 18⅝c.; electrolytic, 17½ @ 17⅝c.; casting copper, 17¼ @ 17½c.

Pig Lead—Carload lots, 4.55 @ 4.60c., f. o. b., New York.

Pig Tin—In 5 and 10 ton lots, f. o. b., 33 @ 33½c.

Spelter—Prime Western in carload lots, 5.70 @ 5⅜c., near future delivery at New York.

Antimony—In cask lots and over, Cooksons, 11 @ 11½c.; Hallett's 9¾ @ 9⅞c.

Lard Oil—Prime city, present make, ice pressed, 44 @ 47c., in wholesale lots.

The Monarch Gasoline Marine Engine.

BY BAXTER ASLAKSON.

This is a two-cycle marine engine manufactured by the Grand Rapids Gas Engine & Yacht Company. It is made in all sizes to 100 horse-power, at present.

Figs. 1 and 2 are front and rear views, respectively, of a 25 brake horse-power engine. *A*, *B* and *C* are admission valves to the crank chambers. *D* is the gasoline mixer. *E* is the water circulating pump, driven from the crank shaft by 2 to 1 gearing. *F* is the igniter driving shaft, connection between these gears through shaft *H* and shaft *F*. By shifting the lever, which is shown projecting above the machine, the period of ignition of the three cylinders is instantly changed. Everyone any way familiar with gasoline engines understands that a late spark will cause the engine to rotate forward, while the early spark will cause it to rotate backwards. In this case we have provided both the early and the late spark—the late spark for the sole purpose of starting the engine easily and barring an accident or a shock to the operator by the engine turning in the opposite direction to that a spark generated by a magneto enables the engine to develop greater power than is produced by a battery, except the battery be new and of corresponding strength. The speed of the engine is regulated entirely by the governor. The governor speed can be changed by simply changing the spring that the governor acts on. This is easily done with an ordinary screw driver, and requires practically no time to secure the necessary alteration in speed.

It will be noticed that these engines are jacketed outside of the water jacket. This is for the purpose of preventing the undue

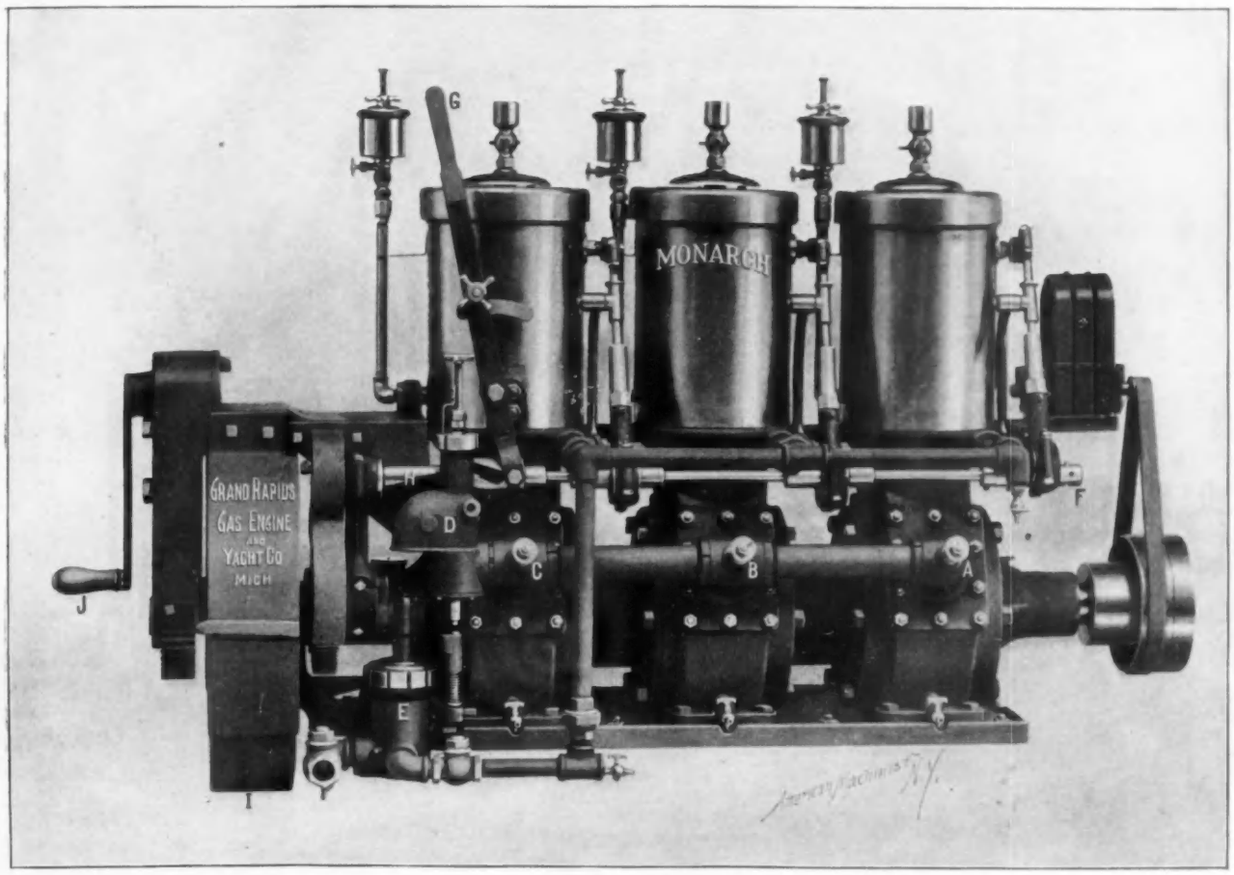


FIG. 1. FRONT VIEW OF 25 BRAKE HORSE-POWER "MONARCH" GASOLINE MARINE ENGINE.

running at the same speed as the crank shaft. *I* is the fly-wheel and *J* the starting crank. The following description of the operation of this engine is by the manufacturers.

Our balance wheel is covered below the center with a metal shield, which is strongly braced so that it cannot vibrate. A train of three gears with intermediate gearing, being 2 to 1, drives the pump which controls the cooling or circulating water and the sparking or igniting device. A single rod *F* with three eccentrics on it is operated by this train of gears, the three eccentrics being for the sole purpose of actuating the sparking device. A sleeve with a spiral groove in it forms the which is intended, and in the opposite direction to that which the operator is cranking it.

The magneto attachment to shelf at the back of the engine is an important feature, as with this device a battery may be used only as an exciter, or to start the engine. When it is under way a three-way switch enables the operator to disconnect the battery and connect the magneto. A magneto furnishes sparks for an indefinite length of time for any number of cylinders, whereas the battery is continually deteriorating by service. The magneto itself will outlast a great many batteries, for practically it is indestructible with proper care. In practice we find that radiation of heat causing inconvenience, or making it possible for the operator to burn himself in handling the engine. We think the jacket is of material service in actual practice.

The water circulating pipes are attached to the engine by unions so that they can be readily removed if desired at any time.

The starting device is so arranged that while the engine is set very low down (just above the keel), and the balance wheel would naturally be below the floor of the boat, the crank for the starting device is above the floor, and the sweep of the handle does not come below the center of the crank shaft, allowing the

operator to maintain a perpendicular position when cranking the engine, and giving him greater leverage over the engine. The gearing by which the connection is made between the crank handle and crank shaft is disconnected from the crank at the first revolution of the engine by its own power, in exactly the same manner as the crank would be disengaged from the crank shaft if applied direct thereto, the disengagement in each case being clearly automatic. A friction spring on the gear on the exhaust side of the engine holds the locking gear free from the balance wheel after the first impulse of the engine. This gear is supported on a sleeve and is not journaled upon the crank shaft, so that when disengaged there is no friction between it and the crank shaft.

The engine is operated by a single vaporizer on which the governor, concealed in the balance wheel, operates. We find that the single vaporizer answers perfectly for the three cylinders. There is no object in having more, and by curtailing that principle we have materially minimized the machinery which the operator would have to adjust, for now we have but the one valve to open and the engine takes care of itself thereafter.

New Vehicles at the Electrical Exhibition—III.

Since detailed drawings of the principal features of Riker's electric vehicles have very lately appeared here it is not needful to refer particularly to this work at this time. Nor is Riker alone in having plenty to do. During the last week of the exhibition at the Garden I was informed that all the wagons shown were sold, and that each of the companies represented had received large additional orders for vehicles. In the parade of electric carriages, May 24, fifty fine electric wagons were in line, making an imposing show, and marking the popular favor in which the automobile is now held, although the police regulations in regard to parades were applied to debar these vehicles from Central Park and Riverside Drive.

Continuing the description of things shown at the Garden, Fig. 11 discloses the construction of the Waverly wheel, which has straight spokes, 5-32 inch diameter, japanned, and steel rims pierced with square holes to take the inwardly projecting square nuts, shown in Fig. 12, on the insides of the pair of uninflated tires. These nuts have flanged outward ends of considerable extent, which are vulcanized into the fabric of the tire. The squared part of the nuts extends through the square holes in the rolled and brazed steel tire, and is covered by cupped washers, through which screws are passed and turned up hard in the tire nuts. There are eight of these nuts in each tire, and the tires are not cemented on, but are secured wholly by the nuts and screws passing through the steel rim. It is quite needful that the tire nuts should register correctly with the rim perforations which receive them, and that there should be no lost motion between the nuts and rim. Some makers depend upon cement and bolting through the rim, and such construction does not prevent the tire from creeping in heavy service. The diameters of the wheels are, front, 34 inches; rear, 36 inches. The front tires are 2½ inches diameter, the rear tires 3 inches diameter. The front tires cost $28 each, $56 a pair; the rear tires cost $46 each, $92 for the pair, making $148 for the complete set of four pneumatic tires.

The front wheel spoke base is 4⅝ inches. The rear wheel spoke base is 6½ inches.

The driving-wheel gears are phosphor bronze, and the motor pinions are steel,

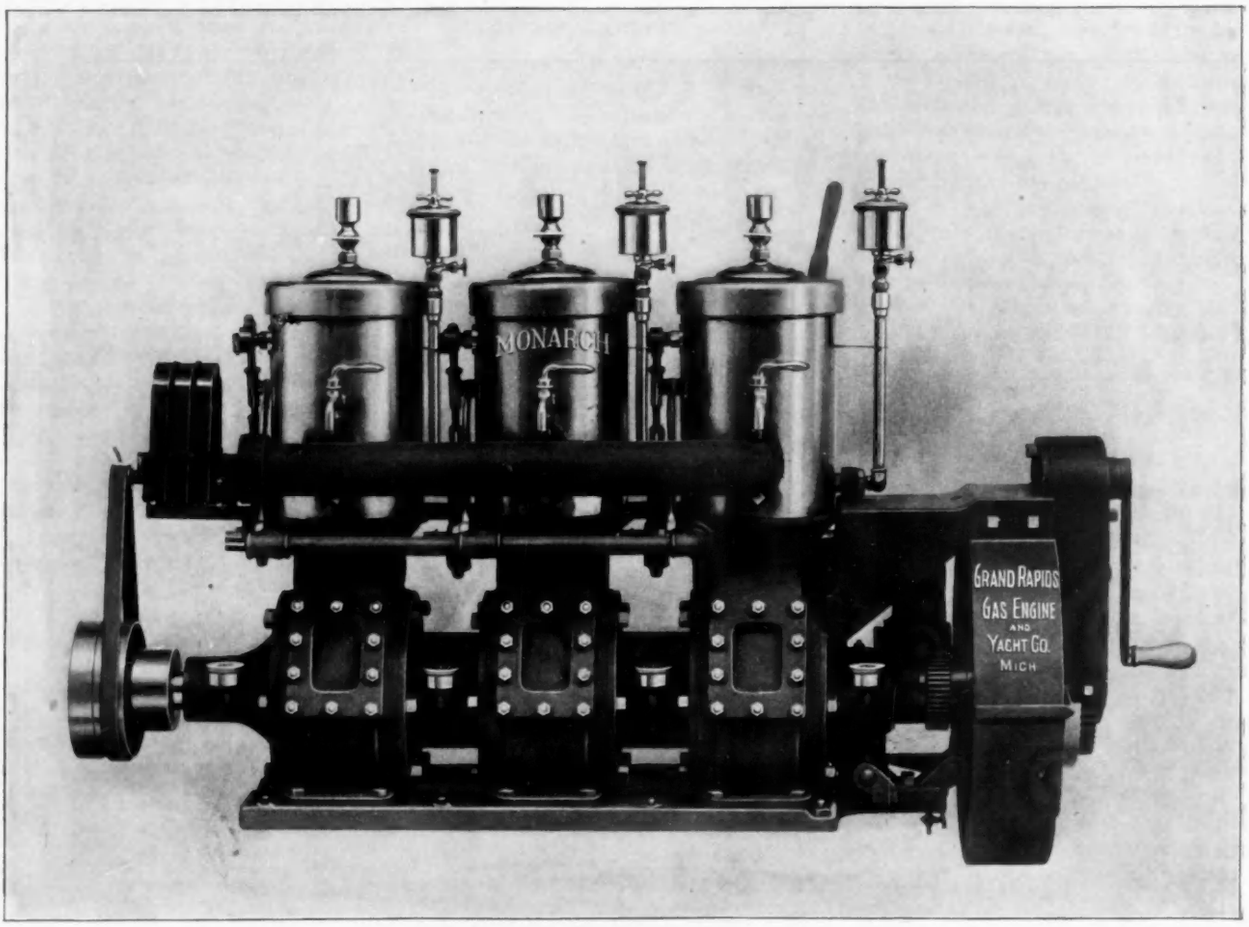


FIG. 2. REAR VIEW OF ENGINE SHOWN IN FIG. 1.

with 15, 18, 20 and 24 teeth, according to the gear reduction.

The Waverly officials expressed approval of the wheel and tire as shown in Figs. 11 and 12, asserting that it gave no trouble of any kind.

Fig. 13 shows the Waverly hub, compensating gear, ball cup and balls, and the double-tread cone. The cone is made with two treads for the balls, as the construction demands enough width for the double tread, and if one cone track is cut the cone can be turned round on the axle and the other tread used. The balls are 3/8 inch diameter. The cups and cones are of tool-steel, the cups being dropped from sheet metal. The compensating gear is applied to the motor shaft, the driving wheels running free on the rear axle and each being driven directly by a gear and pinion reduction of about 10 to 1, enclosed in a dust-proof case. The commutator is placed at one end of the single motor, and the compensating gear is placed at the other end. This makes a symmetrical construction, and as the speed of the motor shaft is about ten times that of the drivers, the compensating gear becomes a very small, light and inexpensive detail. I am unable to give exact dimensions of this little compensating gear. The two pinions are mounted on finished trunnions projecting from a ring of rough steel casting which encircles the motor shaft with, perhaps, 1/2 inch clearance. The pinions have 15 teeth and are about 1 3/4 inches diameter at large end. The gears have 35 teeth and are about 3 5/8 inches outside diameter. Both pinions and gears are of phosphor bronze, cut teeth, with abundant end shake. The motors used by the Waverly are of 1 1/2, 2 1/2 and 4 actual brake horse-power, each motor being carefully tested for torque. All motors are of the same general construction.

The Waverly delivery wagon is framed like the lighter vehicles, but has a double-geared speed reduction, as shown in Fig. 14, a short intermediate shaft with a small gear at the inside end, driven by a pinion on the end of the motor shaft, and a pinion on the outside end which engages the driving-wheel gear; all the gearing being perfectly encased. The motor shaft and the two counter shafts are on plain bearings. The motor is supported rigidly on the tubular reach. *B*, Fig. 14, is the treadle-operated brake rod. The brake band is pulled both ways by the lever, which has the common double-cranked operating end, and as the band is applied to the compensating gear drum on the high-speed motor shaft, the brake is highly effective. The rear body springs are of the usual three-half elliptic-linked form. The wheels are of wood, with solid tires.

The delivery wagon frame is carried forward much the same as in case of the lighter wagons, and the front axle is pivoted at the middle to swing in a vertical plane; but the front axle construc-

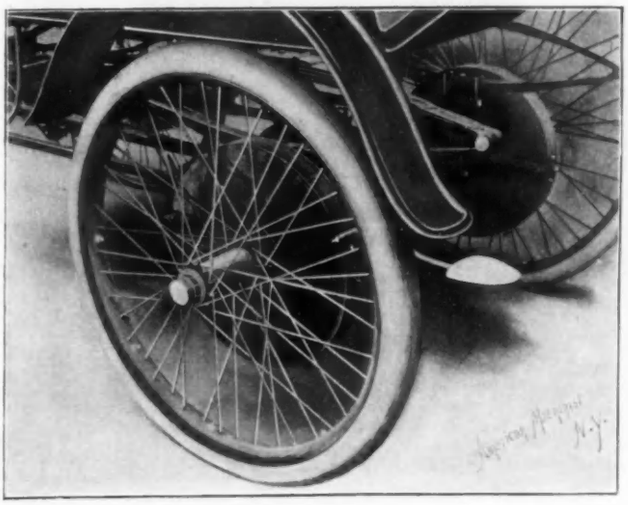


FIG. 11. WAVERLY WHEEL.

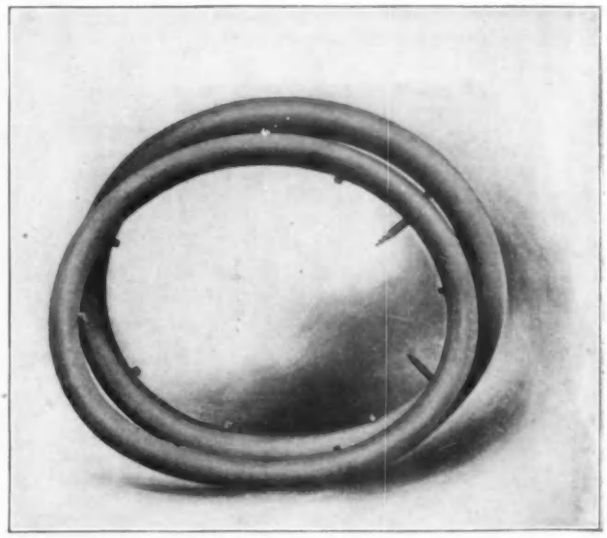


FIG. 12. WAVERLY VEHICLE TIRES, SHOWING METHOD OF ATTACHMENT TO RIM.

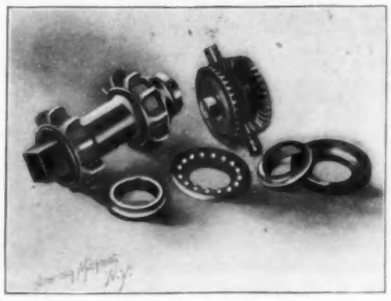


FIG. 13. WAVERLY WHEEL HUBS, COMPENSATING GEAR AND BALL CUPS.

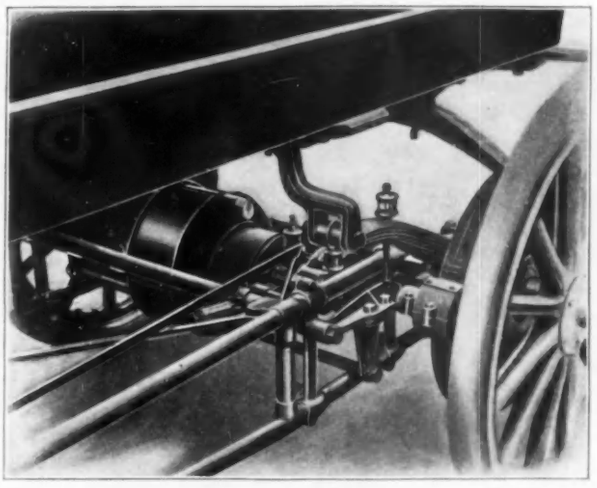


FIG. 14. WAVERLY REAR AXLE AND DOUBLE REDUCING GEAR OF DELIVERY WAGON.

tion is quite different, the axle being a straight forging, trussed with flat iron bars top, bottom and front, all as shown very clearly in Fig. 16. The axle ends are formed into very substantial forks for the pivoted steering axles, and the pins are inserted at an angle, so that the pin axis, if prolonged, would nearly meet the center of wheel and road contact. If this axis exactly intersected the contact point,

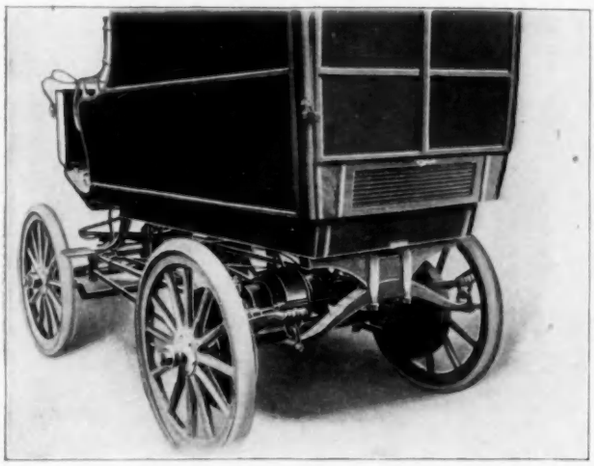


FIG. 15. REAR VIEW OF WAVERLY DELIVERY WAGON RUNNING GEAR AND SPRING WORK.

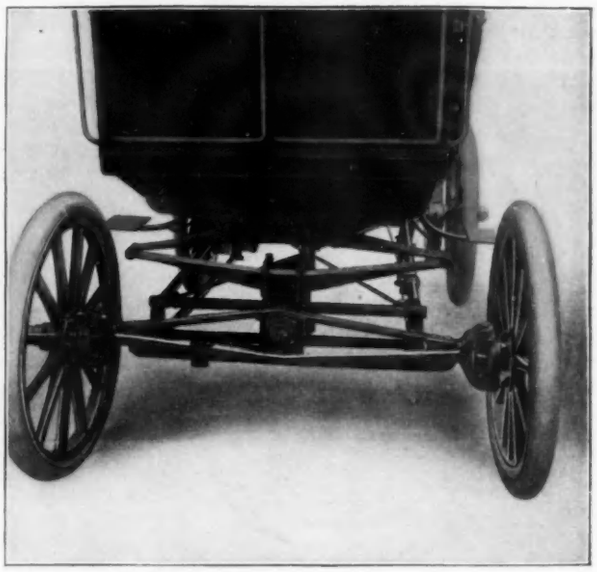


FIG. 16. WAVERLY DELIVERY WAGON. TRUSSED FRONT AXLE AND SPRING.

it would infringe the claims of one of the Duryea patents. Such is the vast difference between tweedledum and tweedledee. As shown by Figs. 15 and 16, the whole framing and wheel support of the Waverly delivery wagon is very substantial and workmanlike in every particular.

The steering gear is shown in Figs. 17 and 18, and consists of an upright hollow shaft carried in a vertical sleeve, bolted to the body floor, having a hand steering wheel secured to the upper end, the wheel being provided with a handle, all as clearly shown in Fig. 17. The screw *S* is splined into the lower end of this hand-wheel-operated vertical sleeve, so that the sleeve and screw must rotate together, but may rise and fall independently. The screw *S* is ¾ inch pitch, single thread, 1⅜ inches diameter, and works in a trunnion nut, the trunnions sliding in slots in the jaws of a fork formed in the end of the horizontal member of the steering bell crank, which is pivoted at B, Fig. 17, on a prolongation of the front axle pivot, to swing in a vertical plane. From the down-hanging end of the vertical member of the steering bell-crank a double-globe-end connecting rod *R* leads to the parallel bar *P*, which connects the steering arms which are fixed to the front wheel axles. This is an extremely simple, substantial and powerful steering mechanism, and is rapid in action, two complete turns of the hand-wheel effecting the entire angular movement of the steering wheels. Where the axes of the axle fork pins are inclined, as in this case, to nearly intersect the mid point of wheel and road contact, the steering wheels require but very little power to move them, as they come very near turning on the road contact as a center. Of course, the introduction of the screw and nut prevents any transmission of shock from the front wheels to the hand-steering wheel. The use of the screw in this combination is very old, and it is also very good.

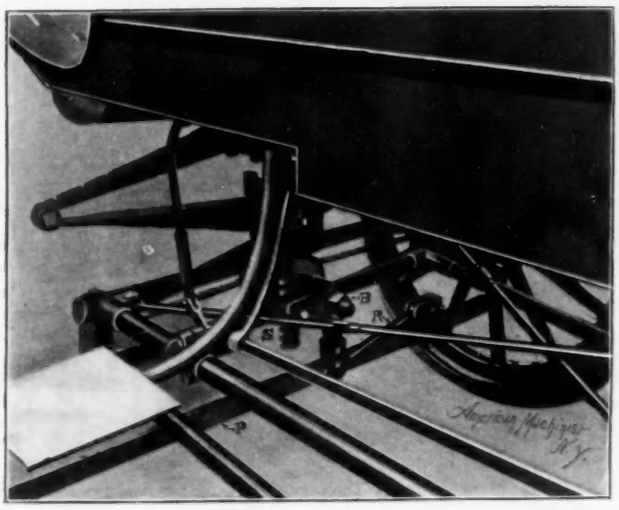


FIG. 17. WAVERLY DELIVERY WAGON. STEERING MECHANISM.

FIG. 18. SIDE VIEW OF WAVERLY DELIVERY WAGON.

Fig. 18 is a complete side view of the Waverly delivery wagon. The outlines are agreeable, and the general effect is businesslike. This wagon is intended to carry two persons and 800 pounds of

goods. On a level the goods load may be as much as 1,000 pounds. A trial run, with a new wagon, two passengers and 591 pounds of freight, in the streets of Indianapolis, gave 54 6-10 miles of travel, with good propulsion left at the end of the journey, for a single charge of the batteries, which weigh 1,452 pounds.

The weights and prices of the Waverly electric wagons are as follows:

	Weight.	Price.
Delivery wagon	3,000	$1,600
Runabout	1,300	1,000
Stanhope	1,600	1,200
Large trap	1,700	1,200
Park trap	1,300	1,000

The Waverly Company give out this table of comparisons:

"First cost horse-power delivery wagons of only ordinary character	$250
Two horses, ordinary	300
Harness	100
Stabling, feeding, shoeing, veterinary service, etc., two horses at $25 per month, for three years	1,800
Wages of extra boy with driver, at $25 per month	900
	$3,350
Electric vehicle of largest capacity, first cost	$1,600
Thirty miles per day for three years, or say 25,000 miles at 2½ cents per mile	750
	$2,350

Aside from above showing, it is safe to say that the cost of repairs and renewal of horses will show a large saving in favor of the electric vehicle."

It is a heavy burden to carry 1,452 pounds of battery weight; but it is also a heavy burden to have to transport, say, 1,800 or 2,000 pounds of horse-flesh, which is just as little profitable as the carrying of batteries, and the battery don't eat when it is not at work, and is healthier than a horse. In point of fact, city horse traction is enormously expensive for the effect gained, because the town-used horse works only a very small part of the time.

HUGH DOLNAR.

We are requested to say that the Attleboro (Mass.) Tool Company has gone out of business.

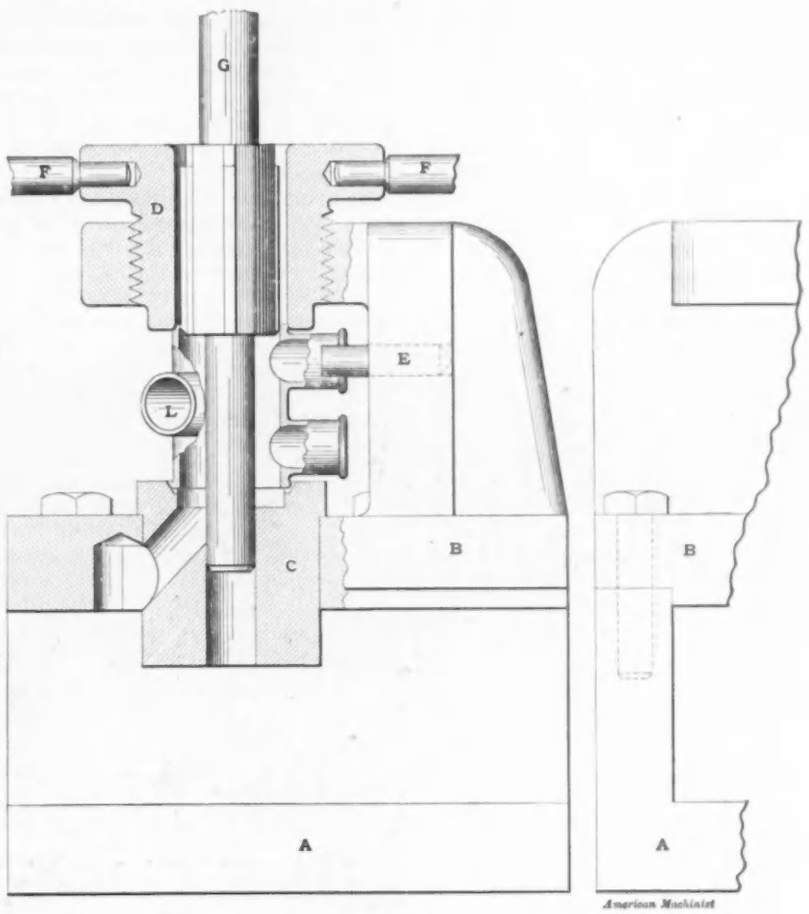


Fig. 1

A CRANK-HANGER JIG.

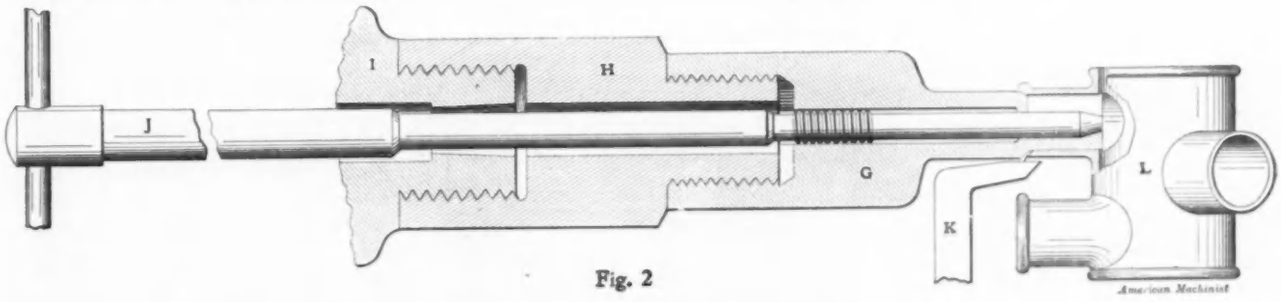


Fig. 2

EXPANDING CHUCK FOR BICYCLE PARTS.

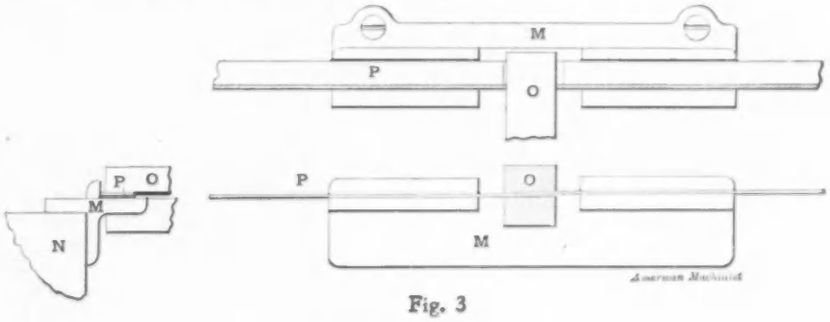


Fig. 3

BAND-SAW BRAZING.

Crank-Hanger Jig — Expansion Chuck—Band-Saw Brazing.

BY A. H. CLEAVES.

The jig shown in Fig. 1 is in use at the Peoria Rubber Company's shop, and while similar to the others described in these articles, has one or two features of interest differing from them. The base *A* and frame *B* are separate castings, and the spider bushing *D* is used as a clamp

only for *L*, the hole being larger than the cutting diameter of the adjustable reamer *G*.

The guide for the reamer in this case is found in the lower bushing *C*, which is provided with three outlets for chips, and a space between the guide hole and the corner where the work rests for the reamer to come out. *E* is a stop pin to keep the work from turning. Four substantial handles like *F* are provided.

Fig. 2 illustrates an expansion chuck used on the engine lathe for trimming off the ends where the brazing joint is made. These are cast with a bulge to admit of clamping in the jigs, and now are held in this chuck to be trimmed down to a knife edge.

The first joint *H* of the chuck is provided with extensions like *G* for the different-sized pieces in use. The chuck is made long to clear the lathe carriage, and an offset tool *K* is used for the cut. The chuck is expanded with a long rod *J* which reaches clear through the lathe spindle and is turned from the rear.

In another article I spoke of the use of a band-saw for slitting seat posts, handle-bar standards, etc. The same method is employed for slotting the ears on the crank hanger for binding purposes and in many other places.

But a simple way of brazing the saw

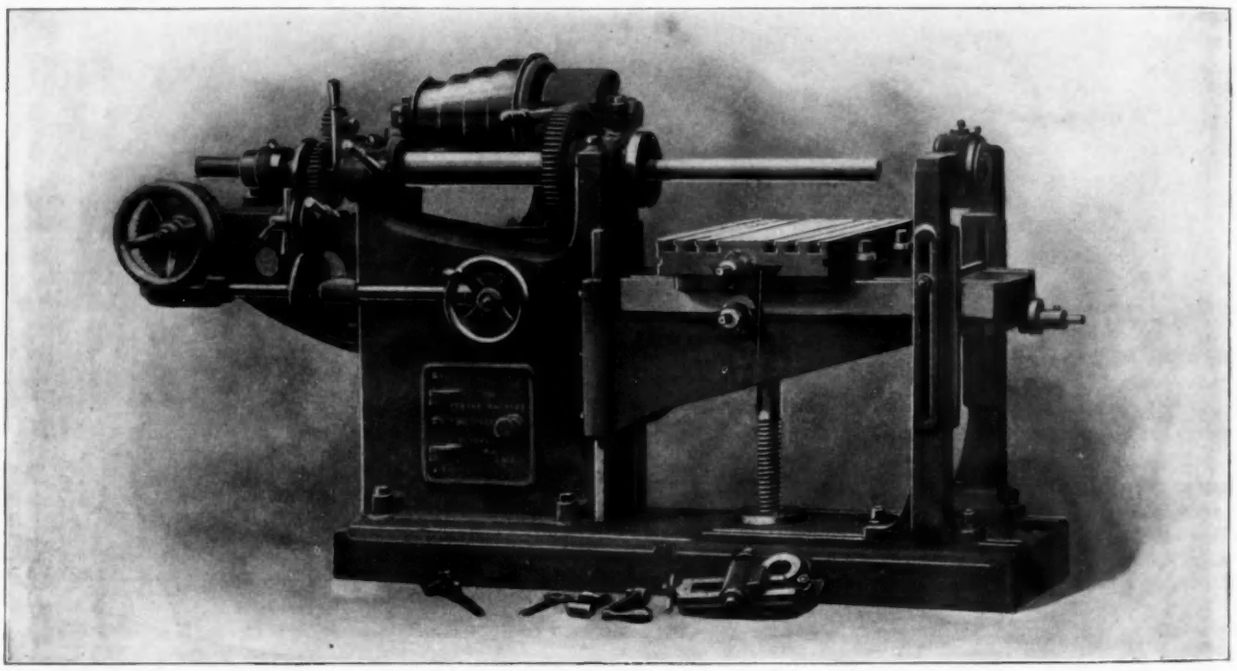


FIG. 1. HORIZONTAL BORING MILL WITH IMPROVED DRIVING GEAR.

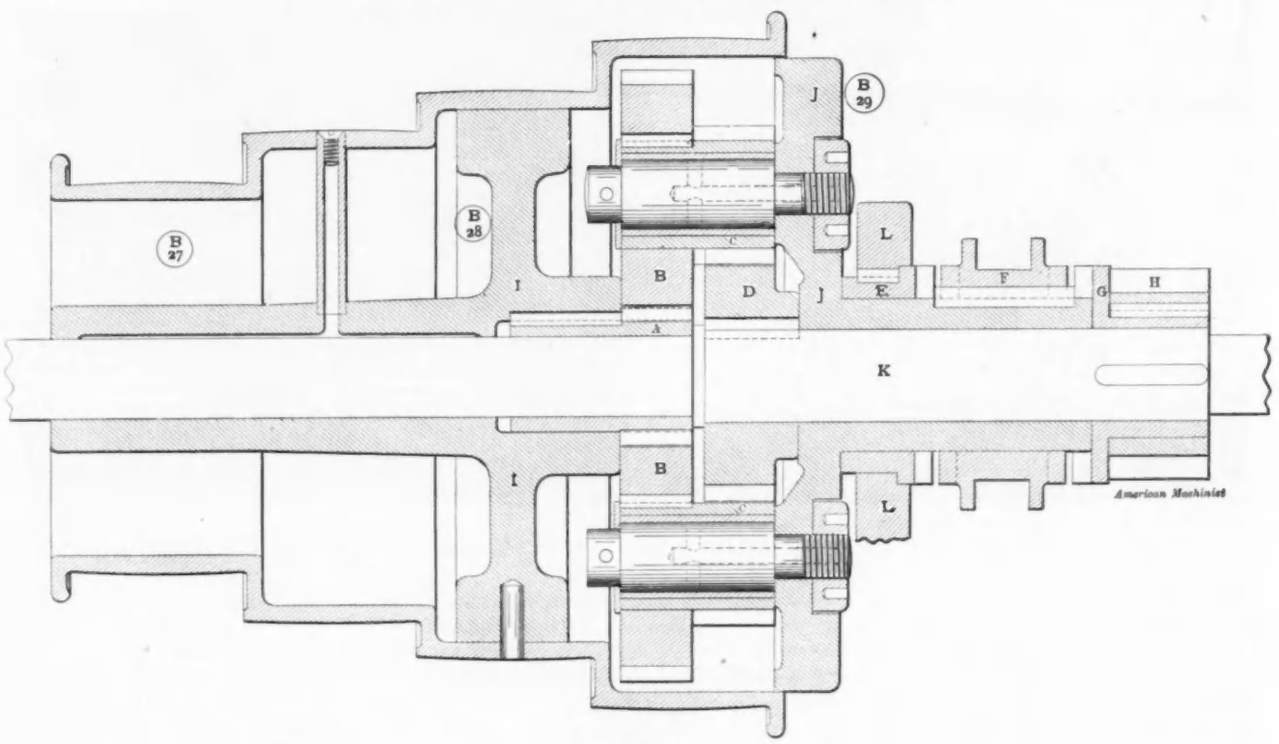


Fig. 2

SECTION OF IMPROVED DRIVING GEAR.

blades is shown here, as it may be of interest in itself. In Fig. 3 *M* is a casting screwed to the bench *N*. The two ends of the saw blade are lapped and laid on ledge of the casting and clamped, which straightens them. No clamps are shown. An opening in the casting admits a pair of heavy red-hot tongs, which flows the brass.

Peoria Heights, Ill.

Improved Driving Gear for Boring Mills, Lathes and Other Tools.

Of the modern machine tools the horizontal boring mill is now one of the most familiar. Like all other tools, it at first had its defects, some of which soon became obvious and others have been revealed by extended experience, while most of them have been successively eliminated. The earlier machines had, and many of the latest also have, the familiar lathe-cone and back-gear drive, the cone being concentric with the boring spindle. The lineal predecessor of the machine shown in the present half-tone, Fig. 1, was illustrated and described in our columns in 1890, and it also had the regular lathe-cone and back gears referred to. Now, to anyone familiar with the work of the boring mill it must have been evident long ago that the belt speeds must generally have been too quick and too weak to be of any value, and practically only the geared drives, with perhaps the slowest of the belt speeds, have been available. In the present machine every speed is such as is called for in the usual range of work that comes to the machine, and every speed gives all requisite power. The bar is in no case directly driven by the belt, but is either double geared or triple geared, according to the gears that are used.

The cone, as will be seen, is upon a separate shaft, above and back of the main spindle, and a pinion upon the cone shaft meshes into a large spur gear on the boring spindle. The rotations of the cone shaft and pinion may be coincident with those of the cone itself, this arrangement being used for the smaller diameters of work, or, by the gearing provided, the cone shaft may turn much slower than the cone. The gearing used is equivalent in function to the familiar "back gears," but is much easier and quicker manipulated, and is entirely clear of the belt.

The gearing arrangement and its operation will be understood upon reference to Fig. 2. The hub of the cone *I* turns freely upon the shaft *K*. The steel pinion *A* is keyed fast to the cone hub and turns with it. The sleeve and disk *J* also turn freely on shaft *K*. In the face of the disk *J* are two opposite pins *L*, upon each of which turns freely a compound gear *B C*, the two pins and the two compound gears perfectly balancing each other. Supposing *J* to be stationary, the rotation of the cone also turns the pinion *A*; and this meshing into the gears *B*, while the smaller gears *C* mesh into *D*, which is keyed fast to the shaft *K*, the shaft is then driven at a speed considerably less than that of the cone. The relative movement of cone and shaft is precisely the same as that which would be produced by the operation of "back gears." The speed ratio is fixed by the numbers of teeth in the gears. If *J*, instead of being stationary, was made to turn with the shaft *K*, the compound gears *B C* could not turn upon their pins, and the entire system then, the cone *I*, the compound gears, the disk *J* and the shaft *K*, would all turn together. These two conditions of *J*, either stationary or turning with the shaft, are secured by simple means. Upon the hub of *J* is feathered the double-faced multiple-toothed clutch *F*. When *F* is moved to the left, it engages the fixed clutch *E*, which is keyed into a stationary hub *L*. The disk *J* is then held from turning, and the slow motion of the shaft *K* results. The hub *L* is part of a standard which supports the forked shipper which moves the clutch. When the clutch *F* is moved to the right, it then engages with *G*, which is keyed to the shaft and carries the driving pinion *H*, which meshes into a spur gear on the main spindle of the machine. With the clutch in this latter engagement the faster rotations of the spindle are secured. With the clutch in the middle position, the cone will turn freely without driving. The simple movement of the clutch from the left to the right is equivalent to throwing out the "back gears" and engaging the locking pin, an operation all too familiar to lathe hands and others. As the face of the clutch has numerous teeth, the cone has to turn but a short distance before the clutch engages, so that the motion is changed from fast to slow or *vice versa*, by the simple movement of the clutch. This arrangement is of course evidently applicable to lathes and other machines, especially if "triple" geared.

Production of Pig Iron.

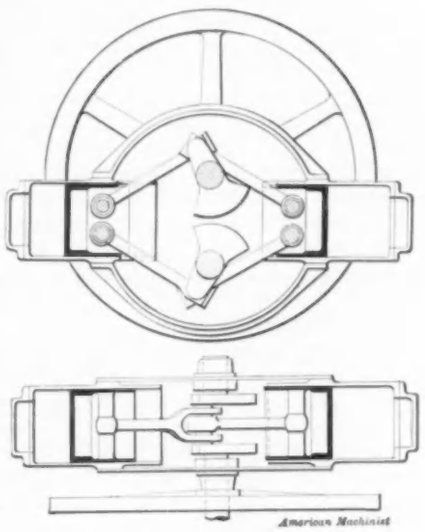
The Bulletin of the American Iron and Steel Association has received from the manufacturers complete statistics of the production of all kinds of pig iron in the United States in the first half of 1899.

The total production of pig iron in that period was 6,289,167 gross tons, against 5,869,703 tons in the first half of 1898 and 5,904,231 tons in the second half. The production of Bessemer pig iron was 3,788,907 gross tons, against 3,703,584 tons in the first half of 1898 and 3,633,800 tons in the second half. The production of basic pig iron, all made with coke or mixed anthracite coal and coke as fuel, was 465,957 gross tons, against 337,485 tons in the first half of 1898 and 447,959 tons in the second half. The production of charcoal pig iron was 128,485 gross tons, against 147,003 tons in the first half of 1898 and 149,747 tons in the second half.

The whole number of furnaces in blast on June 30, 1899, was 240, against 202 on December 31, 1898. The number out of blast on June 30 was 175, of which several have since been blown in and others are preparing to blow in.

A Balanced Engine.

The cut, from an English patent, shows a novel mode of balancing motors, which, "The Practical Engineer" says, has been recently applied to motor-car propulsion with great success. The two crank shafts being geared together, the gears not showing, equal quantities of angular momentum are imparted to each. Both the reciprocating and the turning moments are balanced and neutralized, or nearly so.



A BALANCED ENGINE FOR MOTOR CARS.

The gist of the invention is contained in the patent claim, which is as follows: "In motive-power engines, a method of balancing by arranging two oppositely rotating crank shafts between them, and connecting the piston of each cylinder by two connecting rods, one rod to each rotating crank shaft. A motor constructed in this manner runs with practically as little vibration as a rotary engine or turbine."

The meetings of the New York Railroad Club are to be held hereafter at the rooms of the Transportation Club, in the Manhattan Hotel, Forty-second street and Madison avenue.

It is stated that Armstrong, Whitworth & Co. claim £6,000 damages from the United States Government. The claim is for the alleged infringement of a patent on trunnion bearings for heavy guns.

The Variable Coefficient in Formulas for Friction of Air—Determination of the Coefficient.

BY J. E. JOHNSON, JR.

Inasmuch as many formulas for the friction of compressed air in pipes have included a coefficient which varies with the diameter of the pipe, while the one offered by me in the article published in the issue of July 27 contains a constant coefficient only, it may be worth while to show a possible origin of the variable coefficient of other formulas.

In brief, this lies in the fundamental incorrectness of the formulas. The usual formula which ignores the increase of volume and velocity with decrease of pressure assumes that the loss of pressure is proportional to the length of pipe, which it never is, as a matter of fact, being always greater for a given length near the discharge end than for the same length near the inlet end. What may be called the resistance factor, denoted by R in the former article, is proportional to the fifth power of the diameter of the pipe, inversely; to the square of the volume of free air passing per minute and the length of the pipe, directly; but as this resistance factor is equal to the difference of the *squares* of the initial and terminal pressures, instead of the pressures themselves, the same value of R corresponds to a greater loss of pressure at low pressures than at high.

As a result of this, the ratio of the loss of pressure for two different sizes of pipe is greater than the inverse ratio of the fifth power of their diameters, and to correct for this, a variable coefficient, depending on the diameter, was used in the first class of formulas, to make good the discrepancy, which, however, is not in any strict sense dependent on the diameter at all.

To illustrate this, suppose that we forced 1,000 cubic feet of free air per minute through 1,000 feet of 4-inch pipe with an initial pressure of 150 pounds absolute, and found that the loss of pressure really was, as given by the curve for these conditions, 2 pounds, the value of R being 600. Now if instead of using 4-inch pipe we had used 2-inch, the value of R would have been $(2)^5$, or 32 times as great, or say 19,000, which gives $P_2 = 59$ pounds, which, subtracted from 150, gives 91 pounds loss of pressure, assuming the curves to be correct, whereas according to the older formulas, it should have been 2×32, or 64 pounds only. To make the old formula fit the facts, therefore, a coefficient increasing in value for the smaller sizes of pipe would be necessary.

The case just given is, of course, simply chosen to illustrate the idea, but I think it will be admitted that it shows quite plainly that any formula in which the loss of pressure was assumed to vary directly as the length would require some such additional factor to make it account for the observed facts. It is, in fact, not possible to emphasize too strongly the statement that the loss of pressure is *not* proportional to the length of the pipe. It is approximately so for small losses, but when the loss exceeds one-third of the initial pressure, it is no longer even approximately so, and any formula which shows that it is, is self-contradictory, as it will not give the same results when worked from the two ends of the pipe, or when applied to the pipe as a whole and in sections.

In the matter of the friction of other gases than air, not enough data are at hand to enable one to make an absolutely definite statement; but as the friction of gases is a matter of molecular impacts against the roughnesses of the interior of the pipe, compared with which the molecules are infinitely small, and since by Avogadro's law equal volumes of all gases under the same circumstances of pressure and temperature contain equal numbers of molecules, it seems altogether probable that the loss of pressure under given circumstances for a given volume of gas, measured under atmospheric conditions, is independent of the nature of the gas.

This is only to be taken as applying to cases in which there is no change of temperature during the passage of the gas, and might not apply to the case of saturated steam or ammonia, or any other vapor whose temperature would be materially altered in transit.

This new formula is believed to be sufficiently accurate to fulfill most, if not all, the purposes of ordinary engineering with all needful accuracy; but it is very desirable, nevertheless, that whatever uncertainty is left about it should be removed, so that we should use it with the certainty with which we now use the formula for the flow of water.

It has come to pass that every year there are several hundred young men in colleges and universities working with great energy and intelligence upon "theses," for which purpose they make experimental investigations of any kind whatever that lies within their power, and try for many others, and very often to determine upon a good subject causes them more trouble than its elucidation.

This subject is respectfully called to their attention, and the following remarks upon the method of pursuing the investigation are offered as the result of some thought upon a vexed and difficult question. Such a test is much more difficult to carry out than one upon the friction of steam or other vapor through pipes, because, for the latter, a good-sized boiler and surface condenser are all that are required, besides the actual pipe itself; whereas for the air-friction test not only is a compressor of some size necessary in the first place, but this is almost the least part of the difficulty, for while the compressor will produce the compressed air, it furnishes only a very poor and unreliable means of determining the volume produced.

For a laboratory test or test at the plant of the school whose students undertake it, the following suggestions may be of some use:

In the first place a crank compressor is a necessity, since there are enough other variables, when the stroke is constant, to make accuracy difficult of attainment, and when the stroke is variable, as it is with air-brake pumps, etc., errors of considerable magnitude are almost certain to occur.

To "calibrate" the compressor, obtain a shell or tank of any kind that is airtight and will stand the pressure that it is designed to use. An old boiler shell with the tube holes plugged would do admirably. Mount it on a scale-platform and connect it with the discharge pipe of the compressor. In the discharge pipe have a reducing-valve set for the pressure that is to be used on the pipe-line as the inlet pressure.

Let the compressor run for a sufficient time for everything to come to constant conditions of temperature, etc., discharging into the air through the reducing valve. Then turn the discharge into the tub tank and let the pressure in it rise to that for which the reducing valve is set. Note the time required, number of strokes of the compressor, and weight of air forced into the tank.

This will give the weight of air per stroke delivered by the compressor for that speed and pressure, *but for no other*, unless the compressor is an unusually good one, and then only approximately.

The pipe line should preferably be long enough to reduce the pressure from the given inlet pressure to that of the atmosphere, though if it were made of two sizes of pipe, differing from each other considerably and dividing the loss of pressure between them, the knowledge that the same quantity of air was passing through each would give valuable results.

The reducing-valve, set for the same pressure as on the calibration test, should be at the inlet end, and there should be no sudden bends of any kind after passing it; but to save space for the pipe line, if sections of pipe were bent into return bends of several feet radius, like a shop-heater coil, with several feet between each pair of pipes, the friction would probably not be notably affected. Each size of pipe should have accurate gages at a number of equidistant points along it, preferably not less than ten.

The air should be cooled down to the temperature of the atmosphere before passing the reducing valve. If this be not done it will entirely vitiate the results, or require endless calculations for corrections for temperatures, which would have to be taken at each gage, in addition to the pressure, if the air were not cooled.

From the gage readings at the equi-

distant points, curves could be constructed similar to those I have shown in the diagrams, and the value of the coefficient m determined accurately by analytical methods, which need not be given here.

Given this, and the other data of the experiment, the value of k could be determined with accuracy, and by using different sizes of pipe, none of which need be very large, it could be found whether a variable co-efficient was necessary to express the facts or not.

It is also not amiss in this connection to recollect that in the natural-gas region there are very large pipe lines, conveying enormous quantities of gas through long distances, and with very great ranges of pressure. Also there are enormous storage tanks, or gas holders, used to contain this gas. (One is now being, or about to be, built with a capacity of 5,000,000 cubic feet.) These furnish ideal conditions for a test on a larger scale, probably, than could be made anywhere else in the world; and probably arangements could be made with the owners of some of these lines whereby a test could be carried out with a single pipe discharging into a tank (and none discharging from it) from which the volume of gas delivered could be obtained with great exactness and with simultaneous observations of pressure at a number of points a known distance apart, information of great value to the engineering profession could be obtained with small expense and difficulty.

Some of the Products of Professor W. A. Rogers' Precision Lathe—II.

CIRCULAR DIVIDING ENGINE.

This machine is shown in Fig. 5, although we are unable to give so complete a description of it as of the straight-line machine. A moment's consideration will, however, show that the action of such a machine is essentially the same as that of the straight-line machine, with the screw omitted. That is, we need only the "step-around" mechanism connected to the plate to be divided, the marker and the driving machine. The "step-around" mechanism is obviously applied to a disk mounted just above the foundation plate *a*. The adjustable wedge stop, with its micrometer screw, will be seen at *b*. The plate to be divided is at *c*, and the marker at *d*; this marker being of essentially the same construction as in the previous machine, though differently driven and adjustable on the horizontal cross-piece for different diameters of plates to be divided. The operating machine is at the left, and does not differ essentially from the one already described. The professor's use of mass in his work is even more conspicuous in this machine than in the one already described. While the step-around mechanism and marker comprise all the essential parts of this machine, and it is correspondingly simpler than the other, it will be observed that the number of divisions of an index plate is so great as to call for the most refined accuracy in the adjustment of the movement, and this adjustment must have been correspondingly tedious. Tireless patience is a fundamental requirement in a worker in this field, and this Professor Rogers possessed in a marked degree.

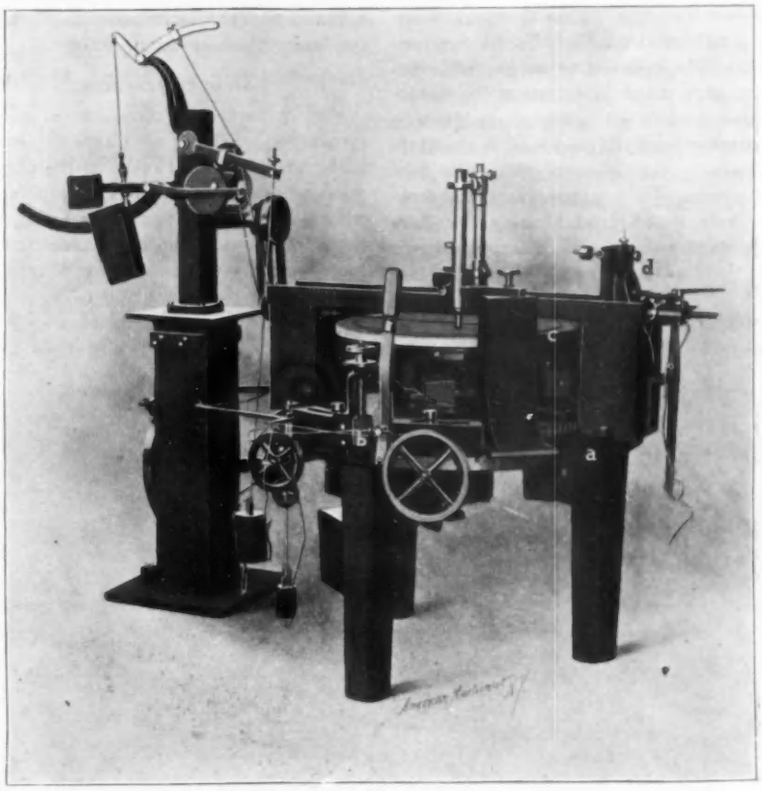


FIG. 5. THE ROGERS CIRCULAR DIVIDING ENGINE.

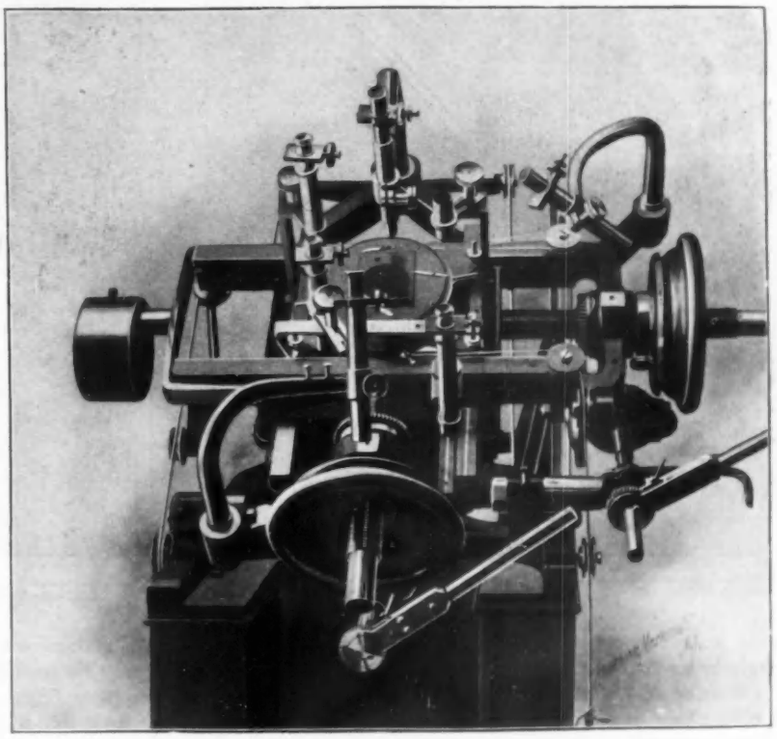


FIG. 6. PHOTOGRAPH MEASURING MACHINE AT HARVARD UNIVERSITY OBSERVATORY.

STELLAR PHOTOGRAPH MEASURING MACHINE.

Fig. 6 shows the most elaborate piece of instrument work attempted by Webber & Philbrick in connection with Professor

Rogers. The instrument involves work by the lathe and both of the dividing engines, and is believed to be the most accurate of its kind in existence.

In the modern astronomical observatory measurements of the positions of the stars are made by first photographing the field then placing the negative on the instrument here shown, and locating the stars under the cross wires of a microscope and reading their location by the two micrometer screws which move the negative frame in directions at right angles to each other. For the coarser readings straight scales are provided and are read through the microscopes above them. The entire value of the observations is involved in the accuracy of the instrument. The straight scales and the divided heads provided work for the two dividing engines, though how the divisions were made on the beveled edges of the plates does not appear, while the screws were, of course, cut on the precision lathe. These are the screws which were referred to in the description of the lathe published in the issue of May 25, as having been pronounced by Professor Rogers to be, within the limits of observation, perfect.

SHOP COMPARATOR.

Fig. 7 shows a shop comparator or measuring machine, of which three were built, one of which is now at the printing press works of R. Hoe & Co., of this city, where it has been used in making hundreds of gages. The chief peculiarity of the machine is its entire abandonment of a screw for the measuring of neat sizes, all dimensions, except the plus or minus one or more thousandths of limit gages, being taken direct from a graduated bar, read through a microscope. The machine is also of unusual capacity.

The picture shows the back side of the machine, the graduated bar being placed on the further side of it, but not being in place when the photograph was taken. It rests on eccentric adjustments for leveling and bringing it within the focus of the microscope throughout its length, the microscope on the near block being swung around to the other side for this purpose. The further block is the stationary block of the machine, and normally occupies the extreme end of the bed. The near block is provided with a traversing gear, which, while delicate as regards the fineness of its motions, has nothing to do with the measurements made. The contact pieces have broad faces, being about 4 inches in diameter, and are, of course, accurately square with the line of motion. They are flanged, the flanges being exactly 1 inch in thickness, and their rear sides may be used in making female gages of over 2 inches gap.

In use the moving block is first moved up to bring the contact pieces together and the zero of the graduated bar—divided, of course, on the dividing engine illustrated last week—is brought to the zero line of the microscope by a micrometer movement of the latter, the graduated and knurled head of which is shown, this movement being used to bring about exact coincidence, as there is no end adjustment of the bar provided. The movable block is then moved down the machine the required number of inches, the required

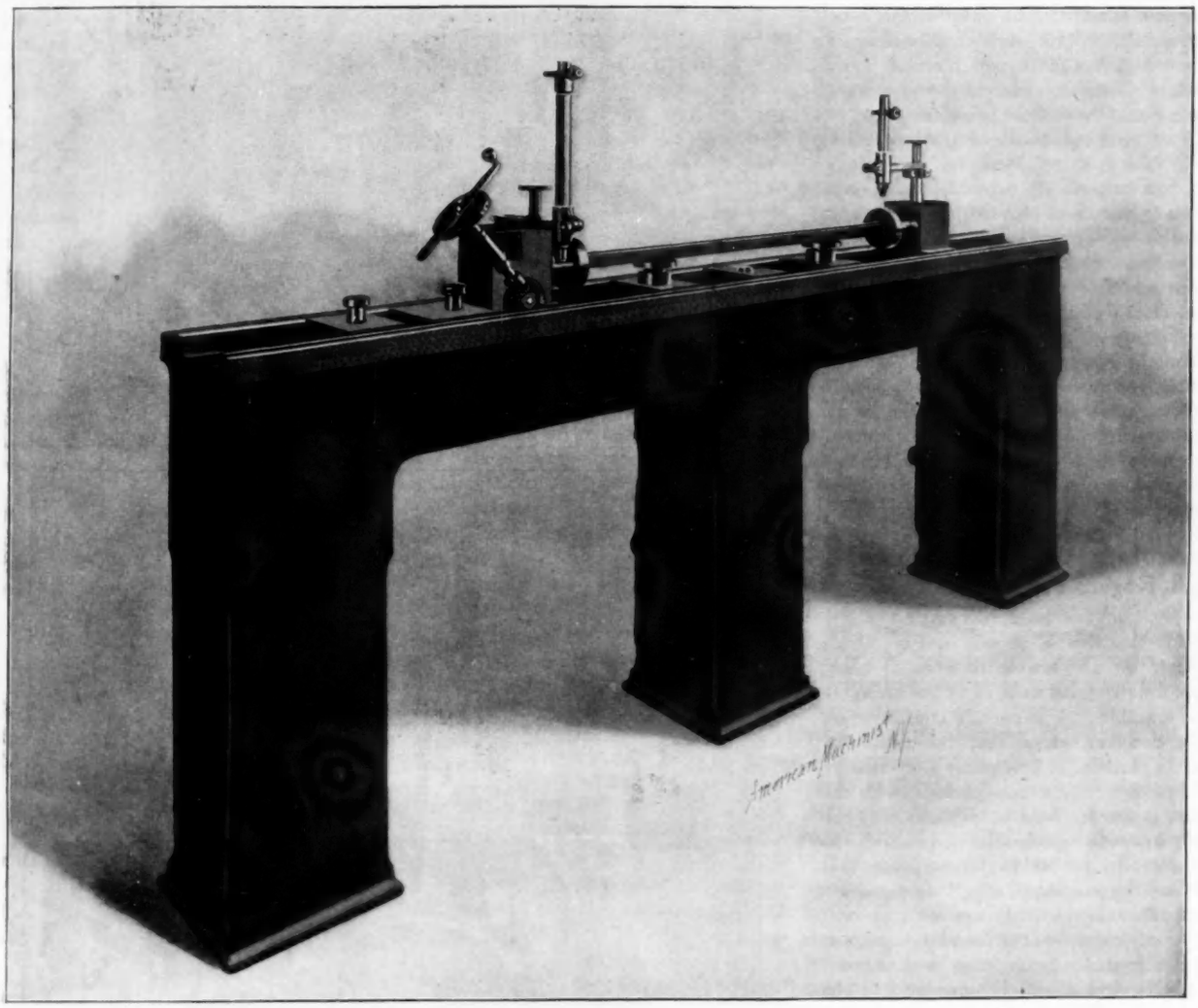


FIG. 7. THE ROGERS SHOP COMPARATOR.

division line of the bar and the hair line of the microscope being made to coincide, when the distance between the contact pieces gives a gap of the same size to which the gage is fitted. The bar is divided into whole inches only, except the first inch, which is more finely divided. If, for example, a 6½-inch gage is to be made, the microscope is initially placed at the ½-inch line of this first inch, instead of the end mark of the bar. A portion of this first inch is divided into thousandths, but, as already stated, the addition or subtraction of one or more thousandths for limit gages is usually made by the eye-piece micrometer of the microscope. The further block will also be seen to have a microscope mounted on it. This is to read divisions on the flange of the contact piece, which is threaded and graduated to give thousands. This seems a queer provision at such a point, and at the Hoe works it is not in fact used.

The length of the graduated bar which goes with the Hoe machine is 40 inches; but this length being repeated in an end measure piece, enables 80 inches to be reached by first locating the contact pieces at 40 inches apart by the end measure piece before using the graduated bar; and 80 inches is, in fact, the original capacity of the machine. Supplementary gage points, however, have been fitted to the blocks on the sides next the operator, and so located as to take advantage of the full length of the bed of the machine. In this way the capacity of the machine has been extended to 110 inches, which is all needed. The writer, at a recent visit to the Hoe works, saw numerous gages made on this machine, which were 8 feet long and upwards. He has, in fact, never seen a shop fitted with such a profusion of high-class gages of all patterns and for all purposes as the Hoe works.

Professor Rogers established a temperature laboratory at Waterville, in which this work was done, and in which, in fact, these photographs were taken. This laboratory was a complete brick building inside a second building, with provision for maintaining it at a constant temperature. This temperature, we believe, was blood heat, in order to avoid any errors due to the animal heat of the operator's person. At the same time the operation of the dividing engines, being automatic when once started, the operator need not stand near them. In addition to this, a supplementary small room was built inside the interior building, into which the observer was not supposed to go at all during the progress of certain experiments—the instruments being read from without through suitable windows. These provisions for eliminating the effects of temperature illustrate more forcibly than anything else, perhaps, the extraordinary delicacy of Professor Rogers's researches.

New Multiple-Spindle Gear Cutter.

The accompanying half-tone and line engravings show a new gear-cutting machine which is the product of the Bickford Drill & Tool Company, of Cincinnati, Ohio, from designs by Mr. H. M. Norris, superintendent of the company. One of the machines has been in continuous use in the shops of the makers for nearly a year, and its success has led to their undertaking its regular manufacture.

The machine is not automatic, except as regards the stopping of the feed at the conclusion of each cut. The designer's idea in this is that with so many spindles an attendant is necessary in any event, and being there, he might as well attend to the indexing as not. Meanwhile, the cost of the automatic indexing apparatus is of course saved.

The appearance of the machine, shown in Fig. 1, would indicate a radical departure from common practice; but it is in points of construction, rather than in principle, that its distinctive features consist. Instead of lowering the cutter to the work, or raising the work to the cutter, as is done on the ordinary machine, the work in this tool is moved sidewise along the ways of the bed, the cutter spindles being set vertically, and operating in the horizontal plane of the index centers.

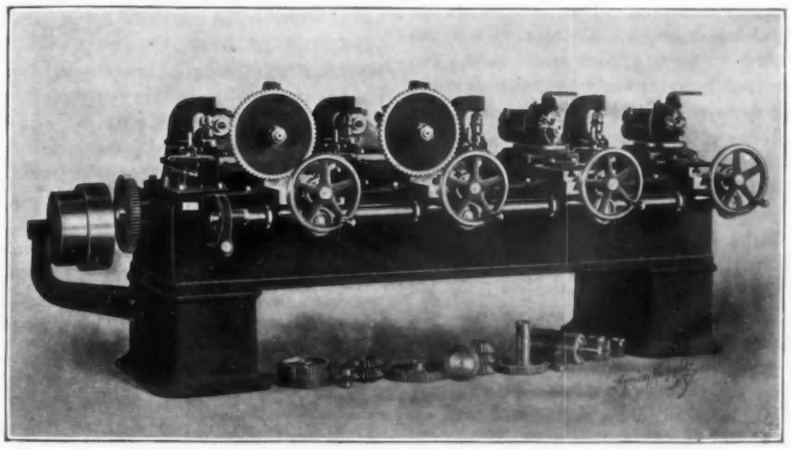


FIG. 1. MULTIPLE-SPINDLE GEAR CUTTER.

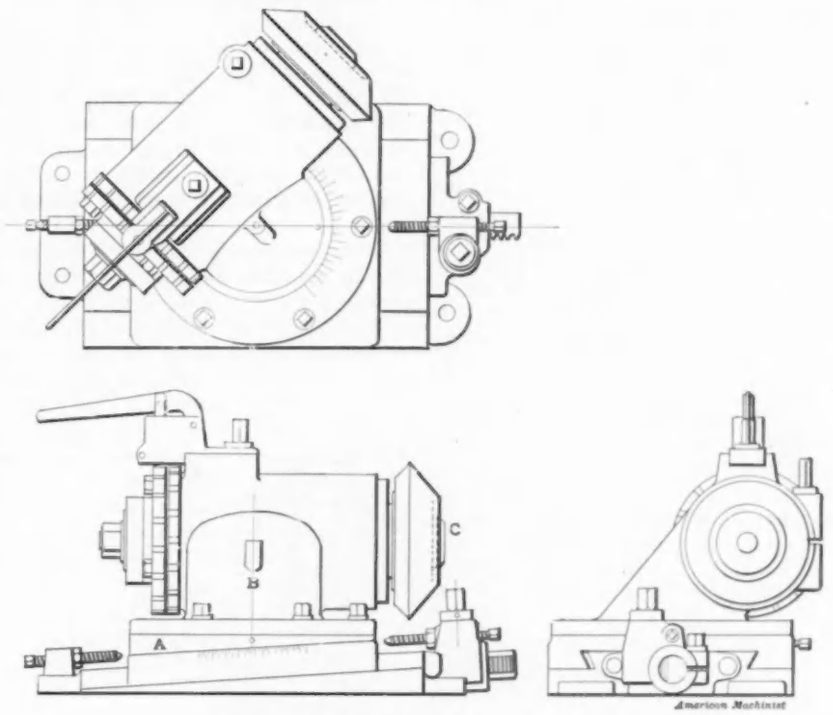


FIG. 2. SWIVEL HEAD FOR CUTTING BEVEL GEARS.

The spindles are driven by miter gears, from a single shaft passing through the center of the bed. They have four rates of speed, and are provided with overhead supports, dust-proof collars, and independent clutch connections, permitting each to be started or stopped at will. The cutters are adjustable vertically, and may be

quickly centered by means of screw collars. The carriages are moved to or from the cutters by screws operated by short snafts fitted with dials graduated to thousandths of an inch, and may be clamped wherever set. The platens have screw feeds, automatic stops and quick-return movement by hand.

The work-heads are made in two styles, plain and swiveling. The plain heads are similar to ordinary index centers, and are adapted for cutting spur gears only. The swiveling heads, shown in three views in Fig. 2, possess all the movements attainable on a plain miller, and are suitable for cutting all kinds of bevel and miter gear work within their capacity. They consist essentially of a swiveling head for holding the work at the proper cutting angle, an indexing device for spacing the teeth and giving the gears a correct "roll," and a raising and lowering device for obtaining the necessary "set-over," each of which settings is easily and quickly made by means of graduations.

To "set-up" for a job of bevel gear work, saddle *A* is first set at zero, as shown by the graduations in the lower view of Fig. 2. Head *B* is then set at the proper cutting angle, as indicated by the graduations on the face of the clamping ring seen in the plan view. The work is next clamped in the head by means of bolt *C*, which fits the bore of the gear at one end, and the bore of the sleeve at the other. The cutter is then raised or lowered until its center coincides with the center of the gear, when saddle *A* is traversed to the right or left until its zero mark indicates the correct set-over, or, in this case, rise or depression, necessary to compensate for the roll given the gear by staggering the index plates fitted on the rear of the sleeve. If moved to the left, the first cut around the gear is made with the pull-pin operating in the outside index-ring, after which saddle *A* is shifted a corresponding number of divisions to the right, and the second cut is taken with the pull-pin operating in the inside index-ring; two cuts sufficing for all gears of less than 4 diametral pitch. The saddle is adjusted by means of a rack and pinion, shown in Fig. 2, and as soon as the proper amount of "set-over" has once been found for a lot of duplicate gears, it is thereafter located by means of stops, also shown. The sleeve is made of large diameter in order to receive suitable bushings for supporting long hub gears close to their faces.

The machine is furnished with two, three or four heads, all of which may be made plain or universal. The capacity of the machine is to cut spur, bevel and miter gears up to 12 inches diameter, 12 inches face and 4 diametral pitch.

An American patent was recently issued to Thomas Humpage, of Bristol, England, for the reducing gear, in which our readers were interested about a year ago.

Liquid Air as Portable Power.

BY FRANK RICHARDS.

In general compressed air practice it has been found most convenient, in keeping records and in making computations and comparisons as to the quantities of air involved, to state the quantities by volume, with the accompanying particulars as to pressure and temperature. Free air, or air at the normal pressure of the atmosphere and at common temperatures, has been the raw material employed, and it has heretofore been very properly the custom to measure and state the quantity to be considered in any given case by its volume in cubic feet. Now that liquid air is to be dealt with, it will generally be found better to go by the weight of the air rather than by its volume. The weight fixes the quantity, regardless of volume, pressure or temperature, or whether the air exists in a solid, a liquid or a gaseous state.

The accompanying table and the diagram Fig. 1, which embodies the same, we have immediate use for, and they will be readily understood without explanation. The weight of a given volume of air at constant temperature varies directly as the absolute pressure. One cubic foot of air at the normal atmospheric pressure of 14.7 pounds, and at the temperature of 60 degrees Fahr., weighs .0764 pound. The same volume of air at the same temperature, but under a gage pressure of 180 pounds, weighs 1 pound, as will be seen by the table and diagram. Having a vessel of 1 cubic foot capacity, we may note the weight of air contained in it at a certain pressure, and then we may also readily see what additional weight of air will be required to be added or abstracted to produce given higher or lower pressures. Thus, at 75 pounds the weight per cubic foot is .4662, while at 100 pounds the weight is .5961, so that to raise the pressure from 75 pounds to 100 pounds .13 pound of air would be required to be added per cubic foot, and this multiplied by the capacity in cubic feet of the air receiver would give the total weight of air to be added.

Weight in Pounds of One Cubic Foot of Dry Air at Different Pressures and at a Constant Temperature of 60° Fahr.:

Pressure	Weight	Pressure	Weight	Pressure	Weight
0	.0764	40	.2842	100	.5961
1	.0816	45	.3102	110	.648
2	.0868	50	.3362	120	.70
3	.0920	55	.3621	130	.752
4	.0972	60	.3881	140	.804
5	.1024	65	.4141	150	.856
10	.1283	70	.4402	160	.908
15	.1543	75	.4662	170	.96
20	.1803	80	.4922	180	1.012
25	.2063	85	.5181	190	1.064
30	.2323	90	.5441	200	1.116
35	.2583	95	.5701	300	1.635

Now, the uses of compressed air are already numerous, and the number of uses and the number of applications under each would be vastly greater but for the necessity which has heretofore existed of purchasing, installing and operating an air compressor in each individual case. The constant care and exertion involved have been more of a deterrent than the expense. The one peculiar and peculiarly valuable feature of compressed air service, as has been previously noted, is that it costs nothing, after it is once fully and properly installed, except for actual service. It is eminently adapted for intermittent and occasional exertions of force, and between times it costs practically nothing for maintenance. There are many cases where an always ready air pressure ranging anywhere from, say, 60 pounds to 100 pounds, would be a great convenience. Instead of the maintenance of a constantly inflowing supply and an unvarying pressure, it might be sufficient merely to replenish when the pressure had fallen to nearly the permissible minimum. The receiver being charged to a pressure of 100 pounds, the use of air during the day, or half-day, or any other period, might not reduce the pressure below 60 pounds, and then if sufficient air was added to bring the pressure up again to the maximum, all the requirements would be met.

Fig. 2

COMPRESSED AIR FROM LIQUID AIR.

This may be accomplished very simply by the use of liquid air, assuming that a system of liquid air distribution has been established, and that it may be delivered to customers as ice, or, rather, as milk is now delivered. One of the serious practical objections to liquid air, and one which is an important item of cost in its use for any purpose, is its volatility. After the air is once liquefied, the process of re-evaporation begins at once, and is continuous, at a rate greater or less according to the access of heat. In the application of liquid air which we are now considering,

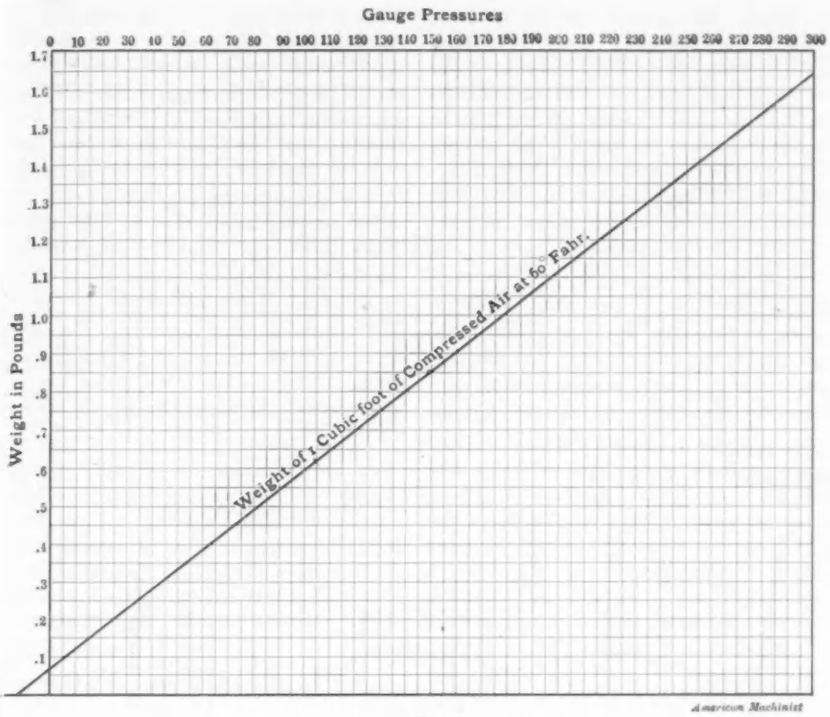
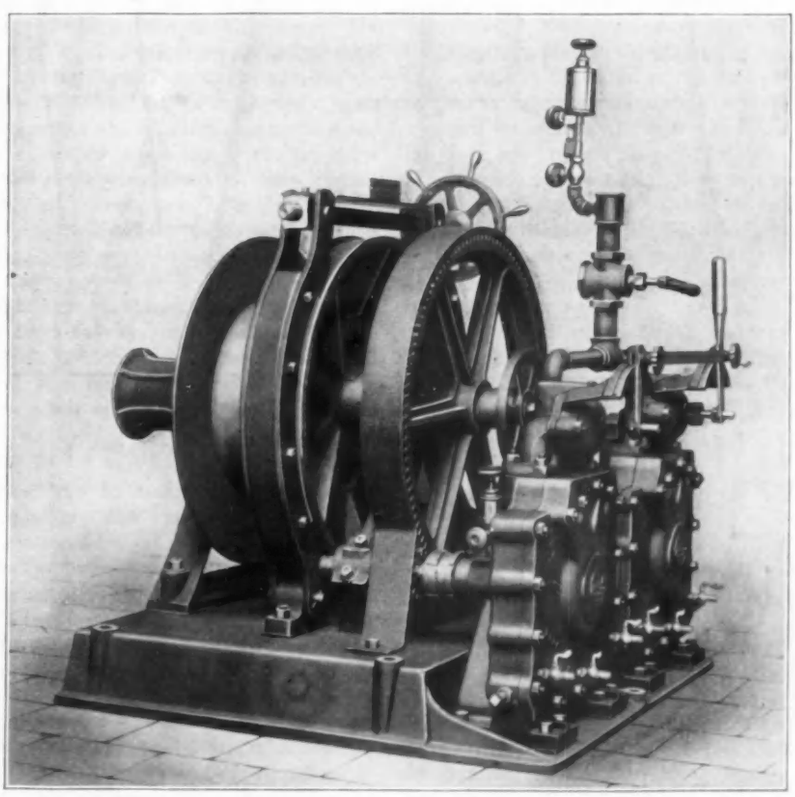


Fig. 1

THE WEIGHT OF COMPRESSED AIR AT DIFFERENT PRESSURES.

this element of loss almost entirely disappears. To use the liquid air for the development of power, it must in any case be re-evaporated, and therefore the loss by evaporation need only be that which occurs during the conveyance of the air, and not at all after it has reached its destination and has been placed in its proper receptacle. We may assume a case showing how the liquid air might be used after the manner here suggested. Say that we have an air receiver *A*, 2 feet in diameter and 40 inches long, the capacity of which will be 10 cubic feet, and that we wish to maintain in it a supply of compressed air ranging in pressure between 70 pounds and 100 pounds. The difference in the weight of air between these two pressures will be, per cubic foot, .5961 — .4402 = .1559, or for the 10 cubic feet it will be 1.559 pounds, which weight of air is to be added to the receiver when the pressure falls to 70 pounds. I have not sufficiently accurate data to offer as to the volume of liquid air which would exactly equal this weight, but I can say that it would be equal, very nearly, to a cylinder 4 inches diameter and 4 inches long. Now, say that Fig. 2 represents our air receiver, with an air-tight chamber *a* of the required capacity for the liquid, 4 inches diameter by 4 inches deep, or a little more, in which to deposit the charge. The chamber should be provided, at any convenient part of it, with a valve *b* opening into the receiver and closing by its own weight and held tight by the pressure behind it. The operation of the arrangement will have suggested itself. The receiver is supposed to have a pressure of 70 pounds. Remove the cover *c* and fill *a* with liquid air. Bolt down the cover, and the air will, by its evaporation, at once generate a pressure greater than that in the receiver, and valve *b* will be opened, and the charge of air will flow into the receiver and be rapidly all evaporated, and the pressure in the receiver will rise accordingly. It would be practically impossible to do this all precisely as described. The air, if poured "in bulk" into the chamber *a*, would boil so rapidly that not only would it be difficult to put on and secure the cover, but much of the air would be lost before the operation was completed. The air should be contained in a suitable vessel, preferably of glass, of a size corresponding to the charge required, and chamber *a* should be also of such size and shape that this vessel would fit in it loosely; then, as the air would not be at once brought in contact with any uncooled surfaces, it would not boil so rapidly. After the vessel of liquid was in place and the cover secured, it would, in any case, very soon be all evaporated and become mingled with the other air in the receiver. The entire contents would, however, be at first so cold that the pressure expected would not be attained, and it might be possible to insert considerably more than the theoretical charge without at once exceeding the required pressure, and if the use of the air commenced at once, it might be drawn off at a rate that would keep down the pressure while the temperature was rising within. The air used should be led through a sufficient length of pipe to allow it to attain normal temperature before it was employed, or loss of effective volume would result, and if the air was used for running a small motor, or any similar service, the reheat-



AN AUXILIARY MINING HOIST.

ing of the air to a high temperature as it passed into the motor would of course greatly increase the volume and efficiency of the air used, as in all such cases. The liquid air may also be used in such a way that nearly its full refrigerating effect may be realized, and then the compressed air service as here outlined in addition; but it will not do to go into that in the present article.

An Auxiliary Mining Hoist.

The half-tone shows an interesting hoist designed, principally for mining service, by E. A. Rix, of San Francisco, and built by the Rix Engineering & Supply Company, of the same city. In mines it is driven by compressed air, although it will run all right with steam, and the machine here shown is designed for loads of 700 to 1,000 pounds. The hoisting drum is 18 inches diameter, and has capacity for several hundred feet of ½-inch flexible steel rope. When the drum is in use, it is constantly clutched to the main shaft, the clutch being seen between the friction wheel and the main gear. The clutch is operated by the hand-wheel seen at the front end of the shaft. The drum is unclutched and left free on the shaft when the "gipsy" on the outer end of the shaft is to be used for hemp ropes for pulling timbers and other heavy service. The friction wheel is a part of the drum casting, and the brake speaks for itself as to its handiness and efficiency. The braking surface is of maple blocks clamped between the wrought-iron bars. The nuts pivoted at the tops of the levers are right and left, and the pilot wheel on the screw gives instant tension or release. The main driving wheel is a spur gear, about 30 inches in diameter, with cut teeth. Into this mesh the two pinions on the two Dake engine shafts, bearings being provided for the shafts outside the pinions. These engines, as most of our readers know, have pistons with rectangular movements, and have no dead centers, so that the hoist starts with equal certainty from any position, and the engines, being of 7 horse-power each, have sufficient power to start the heaviest load for which the hoist is designed. The use of two engines instead of one divides the load on the gear teeth, and it also affords an opportunity for compounding, with a large reduction in the air consumption. The hoist here shown is in use on the 1,400-foot level of the Gwin mine, Calaveras County, California. A larger hoist on the same general plan was furnished the North Star mine, Grass Valley, California, with the difference that four engines were used—the first for initial high pressure, and the others for a lower subsequent pressure, the air being heated both before entering the first cylinder and when passing from that to the others. The engines are reversed by simply changing the port connections, the levers of the two engines being connected as shown, and always moving together. The usual position of the runner is behind the machine, as here shown, where he has the brake wheel, the clutch wheel, the throttle lever and the reversing lever all within easy reach.

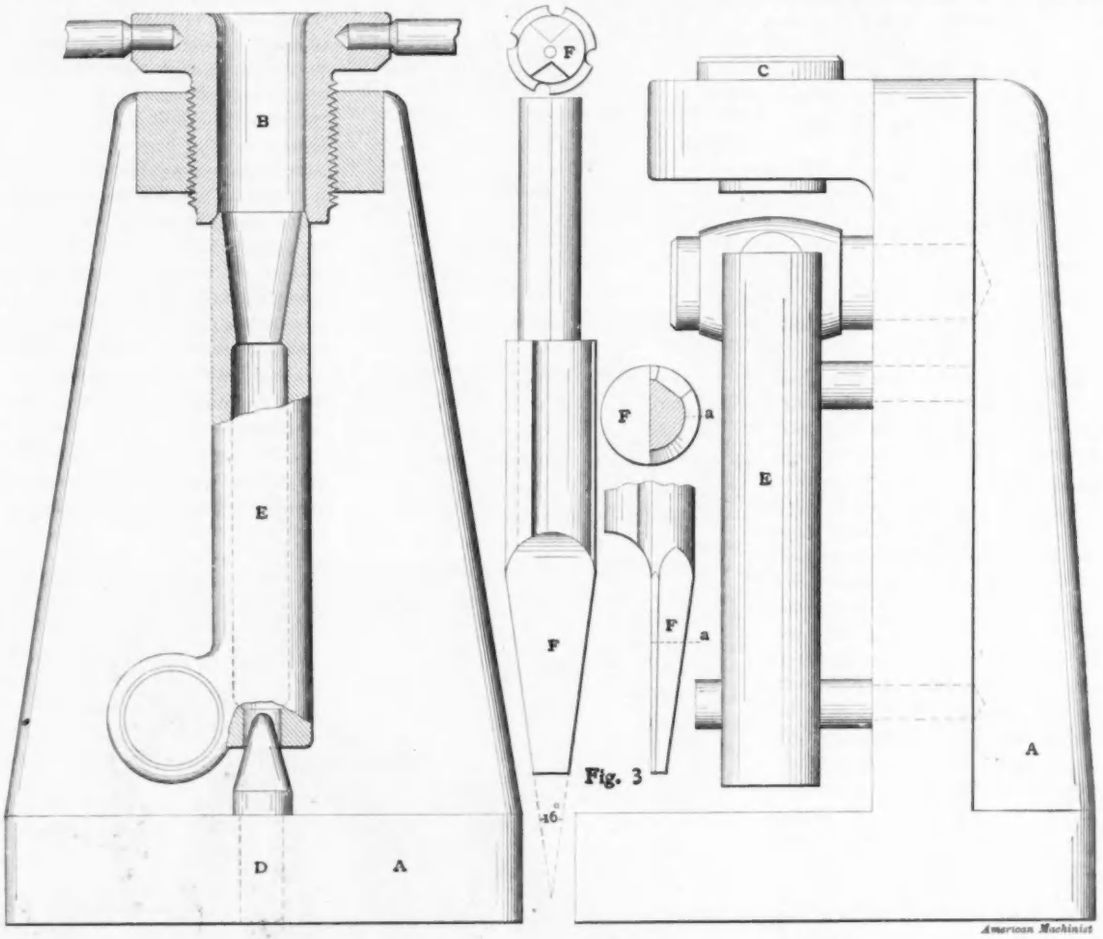


Fig. 1 Fig. 3 Fig. 2

SOME BICYCLE JIGS.

Another Bicycle Jig.

BY A. H. CLEAVES.

The accompanying cuts illustrate another style of jig used frequently at the Peoria Rubber Company's works. Two views of the same style of jig serve to show different methods of holding work, and another cut gives an idea of a reamer for making the taper hole for the seat post and handle-bar stand cones.

The machine business (generally pro-

lific of conventional terms) gives the name of spider jig, I believe, to such a one as is seen in Fig. 1, owing to the appearance of the clamp-bushing combine at the top, with its four spreading arms or long handles. This bushing *B* clamps centrally the piece *E* and guides the reamer *F*, Fig. 3.

For opening the hole resting on the stud *D*, Fig. 1, the piece is held in a reverse position, as seen in Fig. 2, the offset hole in *E* resting on a heavy stud, with a smaller one for a back stop and another for a side stop. No clamping is done in this work, except to secure the jig to the drill-press table.

The reamer *F* is milled half way off and beveled, as shown, to cut, being 16 degrees taper in this case and well provided with flutes for the lubricator to run down, the latter being pumped on to the tool continuously. The material worked on is malleable iron, and the reamer illustrated here gives the best of satisfaction.

Peoria Heights, Ill.

Letters from Practical Men

How Not To Pay Off.

Editor American Machinist:

Mr. Fulton some time ago asked the question of how to pay off, and in reply to the inquiry Mr. Speed indicates a method. Would he like to be paid by it? By what code of ethics a man should be compelled to get into the semblance of a press gang and stand waiting fifty minutes—or five minutes for that matter—for that which is concededly his, it is hard to see. Who pays for the time lost in waiting? Are workmen so far removed from humanity that such humiliating treatment must be accorded them? Are the company's other just bills paid in any such manner? Well, I guess not.

So the workman is "allowed" to form a rear guard, and if for any cause he fails to get there, he can, perhaps, go hungry until Monday noon. The workman ought to appreciate such consideration. A certain corporation in mind does this act; even goes one better, by compelling its employees to pass in front of the paymaster's window, they being outside and out of doors, exposed to the inclemency of the weather. Of course, the officials themselves do not have to stand outside in the rain or snow, as the case may be, and wait their turn. What do they care for their employees, except to depend upon them to turn out the work so as to get a good profit out of them. Is this not naturally asked by the workmen, or if not asked, at least thought?

The edifying spectacle of a respectable-sized regiment of men tramping and jostling in the snow and slush of a winter's day to get what they have earned presents an equal contrast between their mental and moral condition and that of others for whom more thought and consideration are given by their management. Where is the danger of paying off by passing through the factory? Is it because of fear from robbery? Truly a pretty state of affairs.

But most concerns have foremen to whom they trust the management of their employees and who are responsible for the results attained in their departments. It is possible to also intrust them with the distribution of their pay envelopes. The foreman is the best acquainted with the men individually, and in case of any errors being made he must usually be consulted for their adjustment. He it is who knows of any absences, and is less liable to mistake his men. Again it gives him a golden opportunity to make comments, if desirable, when delivering the envelopes. The men will have more respect for him if they learn to regard him as paymaster as well as foreman. One prominent concern makes use of checks in paying, a certain color being used for five dollars or less, another tint between five and ten dollars, etc. There is here less liability of error, as there is no change to be handled. A piece of paper will not be so readily lost as a small coin, or, if lost or stolen, recovery is more probable; furthermore, the check is in itself a valid receipt, which an envelope is not. The worst fault is that checks are not always readily negotiable and frequently lead to using the saloonkeeper as a money changer.

I would suggest that the pay rolls be made up as usual, from the time clock or slips, the envelopes filled out and the amount marked underneath the flap—this in case the figures do not tally with the sum inclosed—then the workman's name and number should be on the outside and the envelopes given to the various foremen for the distribution in their respective departments on Friday afternoon. This gives time for adjustment of any difficulty or errors before the beginning of another week.

But after all that may be said concerning different ways, means and methods of paying off operatives, the fact is that those who have authority in the matter have minds of their own, and if disposed to treat their workmen as men they will do so, and if as brutes they will do it, and the men will stand it or quit.

OPERATIVE.

Scroll Chucks.

Editor American Machinist:

Probably all of us agree that the critic is a valuable member of society; and it may even be maintained by some that he should receive all of the credit for the advance in mechanic arts. I for one am very willing to accord him a fair share of credit for the achievements of the past, perhaps because inclined somewhat to criticism myself; but the really valuable and helpful critic, and the useful member of society who deserves the credit is the one who not only points out the defect, but also suggests the remedy; or if not *the* remedy, at least a palliative. This brings me to the point, which is an inquiry as to the precise standing of our friend Mr. Tecumseh Swift in his criticism of the scroll chuck, which appeared in the "American Machinist" of July 13. Certainly his criticism was sufficiently sweeping and condemnatory; but I fail to find in connection with it any suggested remedy; and without this I am afraid his remarks should class with the unproductive utterances of the chronic kickers who look on, rather than really work for the general good.

Not having the advantage of Mr. Swift's acquaintance, this may of course be my misjudgment. But I take exception directly to his general proposition that "whatever is is wrong." Instead, I believe in the "survival of the fittest." Surely none of us retain things wh ch "we have fully learned are wrong," when better things are to be obtained.

The fact that practically all of the heavy modern lathes which are particularly designed for severe chucking work, are being equipped with suitably designed geared scroll chucks, or with geared scroll combination chucks, in which the screw mechanism is only used for adjustment and the scroll mechanism is depended on for gripping power, is such an interesting and pertinent fact in this connection, that it should be prominently stated. The scroll chuck has faults enough, as every user knows. No one knows it better than the manufacturer, who is obliged to maintain a hospital for infirm and broken-down specimens, with an official staff especially qualified to deal with such cases. But are there not "others" also? My own information is to the effect that the screw chuck, and particularly the universal screw chuck, which is the one with which the scroll chuck must be compared, is also a "frail brother," and not always to be fully depended on.

As to the fit of the teeth and scroll threads, Mr. Swift's sketch is not *exactly* right and does not show the correct form of tooth, such as is produced by proper methods of manufacture, which give much better results.

As to gripping power, I hope you can give space to the following extract from the catalog of the D. E. Whiton Machine Company, to which attention is called, as bearing directly upon this subject:

"These [the scroll and the screw] are practically the only mechanisms which can be successfully employed to actuate the widely adjustable jaws of ordinary lathe chucks. Of the two, the relative leverage or mechanical efficiency of the scroll thread is frequently misunderstood. This holding power in one of our 18-inch heavy geared scroll chucks is more than

twice as great as that of the best form of heavy independent screw chuck, as will be understood from the following: The pitch of the scroll thread employed is 2½ per inch. One complete revolution of this scroll plate will, therefore, move all the jaws engaging with it a radial distance equal to ⅖ inch; or, since the jaws oppose each other, the total effective jaw traverse will be ⅘ inch. The ratio of the bevel gearing employed to revolve the plate is as 1 to 10⅓, so that 10⅓ revolutions of the wrench are required to traverse the jaws ⅘ inch. The pitch of the screw thread employed in our heavy screw chuck is 6 per inch, which we think to be as fine as can be safely used and prove durable. In the independent screw chuck, therefore, the jaw travels 1-6 inch for each revolution of the wrench and screw; 10⅓ revolutions (as in the previous case) will give the jaw a travel of 31-18 inches. The relative efficiency may therefore be stated thus: As ⅘ inch is to 31-18 inches, so is the efficiency of the screw to that of the scroll. Reducing the fractions, the efficiency of the screw chuck may be called 72, and that of the scroll chuck 155. In other words, the efficiency of the 6 P. thread independent screw chuck is only 46.451 per cent. of that of the 18-inch geared scroll chuck. The efficiency of any universal or combination screw chuck, when operated from one pinion (omitting the increased friction), is only one-half that of the independent chuck, but in the final grip it becomes practically an independent chuck by tightening each screw separately in succession, as usually required.

"Further important advantages in favor of the geared scroll chuck should be noted in the following facts: 1. In proportion as the size of the geared scroll chuck increases for larger and heavier work, its gripping power also increases, whereas in the screw chuck this power is constant for all sizes, being no greater in a 24-inch or 36-inch chuck than in a 12-inch. 2. The pitch of the scroll threads can be sufficiently large and coarse so that the working parts have great strength and durability. In a screw chuck having anywhere near equal power, the pitch of the screw threads must be so fine as to wear out rapidly. 3. The loss by friction in the geared scroll chuck is much less than in the screw chuck. In finally tightening the screw chuck, there is rapidly increasing friction on both the threads and thrust shoulders of each screw in exact proportion to the power applied, because the gripping strains, or forces of reaction, are received entirely by the body of the chuck. In tightening the scroll chuck, there is friction only on the threads, as the forces of reaction, being balanced within the scroll ring, are not transferred to the body of the chuck, and therefore do not increase the friction on the revolving bearings. 4. In tightening the geared scroll chuck it is not necessary to apply the wrench successively in different positions around the chuck. Any single application gives the full gripping power."

I hope my assumption is wrong, but Mr. Swift's remarks lead me to think that his experience with the scroll chuck not only dates back to his "very earliest days in the machine shop," but that it has also been confined to that same old chuck, with which he admits having "been disgusted ever since."

The world moves, brother Swift, and other critics have been working on the scroll chuck problem who have applied an occasional remedy, until to-day, with all its faults, its sales are rapidly increasing, and it is practically the only form of widely adjustable chuck which will afford sufficient gripping power and durability for the severest modern requirements.

Lest my remarks may appear to be a little tinged with self-interest, I hope some of the many progressive men who are practically familiar with both styles of chucks, and who are now using more scroll chucks than ever before, will also come to its defense with a few words based on their experience.

L. E. WHITON.

New London, Conn.

Lathe Work at Argentopolis.

Editor American Machinist:

As our friend Sam Better has seen fit to expose my early history, I have no better recourse than to ventilate some of his vain tricks. He once had a number of 6-inch pipe flanges to be threaded, and the spherical surface *A*, Fig. 1, to be faced to a fairly good machined fit for a corresponding female flange. The foreman told him the requirements of the job, then left the rest to Sam. The slots in the face would make it very difficult to produce a smooth surface by hand feeding, so Sam reasoned, and he didn't begin by the hand method, but rigged up the arrangement shown in plan in Fig. 5. The former *B* was made from a scrap of a cast-iron crosshead guide, which had four sides planed and a bolt hole through it. The scrap was bolted to the lathe face-plate, and one edge was turned to the radius to which the flanges were to be faced. The upper face of the lower portion of the foot-stock was but little below the center of the lathe, and to this face the former was bolted by the foot-stock bolt, and set carefully with its arc centered by a perpendicular from the lathe center. The arm C was fastened to the tool block in place of the usual full swing rest for large work, and the tool was ground about the same shape as the nose *D* and set at the same distance from the vertical plane of the lathe centers and at the hight of the centers. The "rise and fall" rest was set in its lowest position, making the tool travel horizontally.

The outfit was now ready to make a fair job by feeding with the automatic cross-feed, away from the center, and making the nose *D* follow the former *B*, with the carriage hand feed. But that kind of "self-feed" didn't suit Sam, so he made two circles of 1-16-inch plate about 4 inches diameter, with holes and keyways like those of the change gears, and slipped them on the feed-cone shaft, with a small gear between for a washer and a gasket rubber washer under the nut, as shown at *E*. By adjusting the nut the flanges gripped the idler gear and so turned the lead screw. The tool was thus fed with both screw and rod feed, the flanges at *E* being oiled and tightened just enough to hold the nose *D* in contact with the former *B*. This arrangement made a neat finish in two cuts, and quite accurate enough for its purpose. Total time of getting the rig in practical operation, about five hours. The flanges (twenty-four, I think) were faced in less than twenty-four hours' time, including the making of the rig; and some of the flanges were rather hard, requiring more than two cuts to finish.

Another job done in this lathe was like Fig. 2, a swinging tuyere cap for blast furnace work. The threaded hole was finished as shown without changing

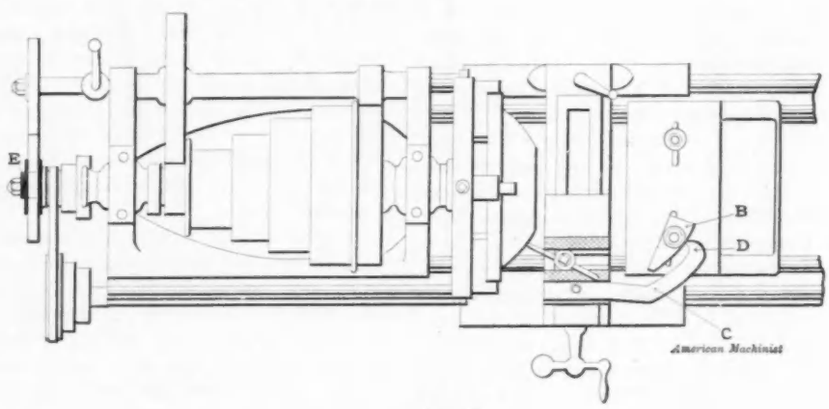


Fig. 5

RIG FOR TURNING A SPHERICAL SURFACE.

tools. The smaller hole was left rough. The casting was bored for threading by using the smooth forged taper shank boring tool, Fig. 3, driven tightly, with pasteboard around it, into the foot-stock spindle. The tool was set by the set-over screws to bore to size in one cut, and fed by hand. The ordinary inside thread tool, Fig. 4, held in the tool post with a little vertical clearance on its end face, faced the boss and chased the thread without changing its setting. Though this tool had to be ground several times, the tail-stock

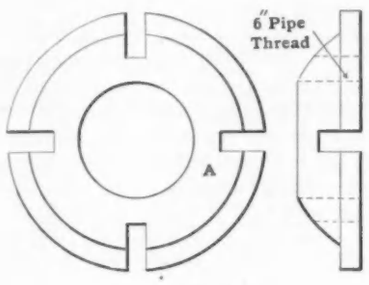


Fig. 1

Fig. 2

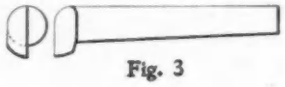


Fig. 3

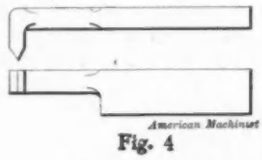


Fig. 4

BORING AND THREAD-CUTTING ARRANGEMENTS.

boring tool bored the entire lot (over 100 pieces) without grinding.

Sam had a belt shifter of his own devising for cone pulleys, similar to Fig. 6. He first tried it without the sliding piece *A*, and found that although it would throw the belt from the larger steps to the smaller ones, it didn't work so well the other way. When the belt was thrown off the larger steps of the lathe cone it would twist between the shifter fingers and refuse to climb the larger step of the countershaft cone when thrown over by the shifter. So the slide *A* was made of about ⅛x2-inch iron, and the holes drilled to slide freely on the ¾-inch fingers *B*, and the space *C* made about ⅛ inch greater than the thickness of the belt, which ran freely through it, but could not twist. The shifter handle was fulcrumed near the roof, giving plenty of length above the countershaft. The fulcrum bolt had jam nuts and beneath them a spring of ⅛x2-inch iron, which made just friction enough to prevent the weight of the shifter from changing its position or dragging on the belt. This shifter throws the belt easily to any step desired on the upper cone, and the piece *A* slides freely in and out to suit the different cone diameters. The wooden shifter handle is hung so as to be vertical when in the center of its swing.

THE JUDGE.

Machine Tools by John Richards—Lathe Improvements—Fine Pitch Gears in Machine Tools—Round Corners.

Editor American Machinist:

As you are well aware, I have been identified with the "American Machinist" in one way and another since the first issue; in fact, was the instigator of the paper, and naturally have taken a great interest in everything connected with the paper. That I have read every number of

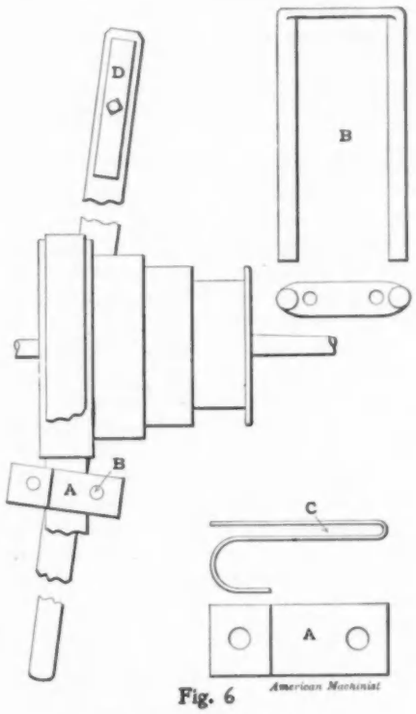


Fig. 6

CONE PULLEY BELT SHIFTER.

the paper since its first issue, goes without saying.

I have read all the various articles on "Machinery Tools," by John Richards, and must say that I have been more interested in these articles than in any others which have appeared in your valuable paper for years. It would be well if every draftsman would cut out these articles and paste them into a scrap book, which he could have constantly beside him when designing new machines. They show that Mr. Richards is a man who has looked into the matter of machine design thoroughly and is conversant with all machinery that is designed to produce machinery. Articles like those of John Richards' cannot fail to make your paper more valuable.

In the July 13 issue, his article on the arrangement of the driving gear for lathes, he shows a shifting gear arrangement for cutting coarse pitch screws. I do not know whether Mr. Richards is aware of the fact, but S. W. Putnam, of the Putnam Machine Company, of Fitchburg, Mass., designed a lathe several years ago (and which they have built ever since) with the arrangement as shown; i. e., so that the intermediate gear for the screw-cutting train would shift from the spindle gear into the cone gear. This arrangement is a very neat and valuable addition to a screw-cutting engine lathe.

Mr. Richards mentions that the gear on the spindle and the cone pinion require to be of the same pitch, and also mentions the fact that it is a distinctive advantage. The writer has been for years a great believer in coarse pitch gears in machine-tool work. Many designers seem to think that if they figure the strength of a gear as a little above the strength of the effective pull of the belt that this is all that is necessary, not taking into consideration the wearing surface of the teeth. I have made several trips abroad, and have taken particular pains to notice the difference in the size, pitch and width of face of gearing used in machine tools in foreign countries and that used in America.

I have lately designed several new machine tools, and have, perhaps, gone to the extreme in width of face and coarseness of pitch, but I believe that if there is any erring in this matter it is on the right side. I was repeatedly shown machine tools of prominent manufacturers from America, with broken and worn-out teeth, and this is one of the principal objections that foreign users of machine tools have against those made in America. It is not always the heavy tool which is the hardest to manipulate.

I was much interested in the editorial on "Round Corners," and as this has been a hobby with me ever since I started to design machinery, I am glad to see it written up by one whom we all know is a good judge of such matters; although there is one part in it in which I must beg to differ. Ye editor's experience cannot have been the same as mine. I find that not only the foreman of a foundry, but the molder himself, will kick if he gets patterns without fillets or round corners. I have never seen the patternmaker yet who kicked about making round corners and filleted patterns. There may be some such men, but it has not been the writer's bad luck to be connected with them.

You also say that round corners and fillets are much more in evidence here than in England. While this may be true in certain works, we certainly must admit

that the machine-tool works of Sir Joseph Whitworth were the originators of the present style of machine tools, with their boldly rounded corners and lack of finished surfaces; with their columns and bases of a nearly correct form, and without the embellishments which were put on to machine tools previous to that time. There are many shops in England that are making machinery to-day elegantly designed and with well rounded corners and with a minimum amount of finish. I do not believe that the wood cuts made in England are intended to make a change in the shape or style of the machines as we make them here. It is simply a matter of the wood engraver, who has been taught to do his work in this manner; and I do not believe that they look better to the majority, at least, of the English mechanics' eyes than they do to ours. I have had a great deal of experience with machine-tool men, both builders and dealers in machinery, in many foreign countries, and they are invariably pleased with the style of our machinery; and really, there are only one or two points in which I have ever heard them express dissatisfaction; these are light gear, small wearing surfaces, and a general tendency to make the machine lighter than they think is consistent with strength and rigidity. However, I think that the American tool builders are gradually waking up to the idea of a little stiffer and stronger construction in all their tools.

JOHN J. GRANT.

Cleveland, Ohio.

A Farmer's Engineering.

Editor American Machinist:

I saw a nice piece of "mechanical engineering" done on a farm by a common farm hand that probably would have done credit to a first-class machinist. It was on a 2 horse-power Charter gasoline engine, whose gasoline valve is held from opening too far by a nut and lock-nut on the end of its stem. These nuts often become loose, and consequently the engine would stop, as the valve opens too wide and is not closed when the explosion occurs.

A couple of days ago the nuts fell off again, and I just happened to come around when the man in charge had just taken out the valve and had found that this time not only the nuts had fallen off, but with them the stem, thread, nuts and all were gone. For a while there seemed to be no other way out than going to town to see if a new valve could be procured; but suddenly the countenance of the rural engineer brightened, and without saying a word he hunted for a nail that would fit the small center hole drilled on the upper end of the valve. He found the nail, took some measurements, pinched off a piece of the nail, drove the remaining piece into the above mentioned hole, put the valve back in its seat, and the engine, as he assures me, has given no further trouble, and in my opinion he not only repaired the engine, but improved it. Instead of the nuts preventing the valve from opening too far, the wire nail, by knocking against the cap of the gasoline pocket, accomplished the same thing.

Randolph, Mo. C. CASBERG.

Paying Off.

Editor American Machinist:

Where I am at present employed there are something over 6,000 men on the pay roll, and, what is more, they are hiring and discharging men every day; but still they follow, without inconvenience, the old-fashioned way of paying off. The day before they pay off the clerk of each department gives to each man a slip with his number and name and the amount that will be in his envelope on the morrow, then if there is any mistake he can look it up and correct it. On the slip there is a place for the man to sign, so the company has his receipt when he is paid. When pay-day comes, the paymaster goes around and pays each department separately. The clerk goes with him and takes up the slips or receipts and the men get their money. It takes about three hours for the paymaster to go around the entire shop, and the men feel as if they were doing business on business principles.

A WORKINGMAN.

The German Tariff on Agricultural Machines and Tools.

Consul-General Frank H. Mason furnishes us from Berlin the following general information concerning the German duties upon imports of tools and machinery:

The duty on agricultural implements, machines and tools imported into Germany is specific and based upon the material of which the implement or machine is principally composed, modified again by the polish, painting and finish or outward decoration that has been applied. These conditions, while theoretically simple, are in practice often exceedingly complicated, so that it is frequently impossible, even for an expert importer, to say positively what the duty on a new article will be until a sample has been imported and subjected to actual classification and appraisal by the customs officials.

In so far as the questions submitted by the Department can be answered from the imperial German tariff schedule, supplemented by the testimony of a leading importer of American machinery, such imports are classified for duty as follows, the rate given in marks, with equivalents in United States currency, being for 100 kilograms (220.46 pounds):

	Marks.	
(a) Machines and parts of wood or cast iron or both.....	3 =	$0.71
(b) Machines and parts of wrought iron and steel or both.....	5 =	1.19
(c) Machines and parts of other base metals or any other ordinary material.....	8 =	1.90

In classifying machinery, the principle holds that where a machine is composed of several different materials belonging to two of the above groups or designations, the machine as a whole shall be assessed under the class to which the greatest weight of its materials belongs, viz., wood and cast iron at 3 marks, wrought iron and steel at 5 marks, and brass, zinc, copper and all other base metals and ordinary materials at 8 marks per 100 kilograms. Thus, if a machine weighing 100 kilograms contains 40 kilograms of brass and copper, 30 kilograms of wrought iron, and 30 kilograms of cast iron, it would be assessed for duty under class (c) at 8 marks ($1.90) per 100 kilograms. If, on the other hand, it contains wood and cast iron weighing together more than all the other materials, it would be assessed under class (a) at 3 marks per 100 kilograms. In all cases the rate of duty is governed by the polish or outward finish of an article, and in this respect the German tariff is peculiar and leads to some curious decisions. Thus the rating of a fireproof safe is changed if, as is usual with safes of American manufacture, a picture is painted for decorative purposes on one of its panels. Thus, also, plows and other agricultural implements, if rough and unpainted, are dutiable at 6 marks; but if polished, varnished or painted, are assessed 10 marks ($2.38) per 100 kilograms. The duty on carriages is doubled when any portion of the vehicle is upholstered.

Tools of iron or steel, alone or in combination with wood and not polished, varnished or painted, are dutiable as follows:

	Marks.	
(a) Rough, as anvils, shafting, etc., per 100 kilograms...	3 =	$0.71
(b) Finished, as axes, hatchets, and mechanics' tools, per 100 kilograms.....	10 =	2.38
(c) Fine tools, polished and varnished, per 100 kilograms.....	24 =	5.71

The following machinery imported from countries, including the United States, which enjoy by treaty with Germany the privileges of the most favored nation, may be imported in detached parts and as-

(*Continued on page 39.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.
Caliper cat. free. E. G. Smith, Columbia, Pa.
Forming lathes. Mer. Mach. T. Co., Meriden, Ct.
Punches & dies. Wal. M. Wks., Waltham, Mass.
Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas,Prov.,R.I. Send for index sheet.

Index drilling, notching dividing plates and dial graduating. The Arthur Co. See page 44.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Iron foundry, all equipped, with factory building attached, near New York, for sale. Box 161, AMERICAN MACHINIST.

For Sale, at a Bargain—One new 3-spindle sensitive drill press; Woodward & Rogers pat. The Cooke Mach. Co., 110 Liberty st., N. Y.

For Sale, Cheap—Second-hand 10 in. Gould & Eberhardt shaper. Wheeler Condenser & Engineering Co., 120 Liberty st., New York City.

Wanted—Machine tools and foundry equipment; $50,000 to invest at once in new and second-hand tools. Address R. E. O. W., AMERICAN MACHINIST.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Bound volumes of "American Machinist" for 1893 and 1894, cloth, good condition, $3 each; one of 1888, morocco, $4. "Volumes," care AMERICAN MACHINIST.

For Sale—Two 12-inch by 5-foot bed engine lathes (new), 1-inch hole through live spindle, complete, with gears, etc. Apply to G. W. Francis, Reading, Pa.

Gear and milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears. Catalog of small tools free. R. M. Clough, Tolland, Conn.

Have a first-class agricultural machine, just patented, partly introduced, with good success and prospect, and have in view a very suitable for sale machine works; capital wanted to push same. J. M. K., Box 6, Maria Stein, O.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—Technical partner, who controls machine shop, for the manufacture of agricultural machine with an annual market of more than 80,000; amply protected by patents of great commercial value and unsurpassed technical merits; cost of material and production reduced one-third. Address Box 133, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Mechanical engineer and draftsman is open for engagement. Box 139, AMER. MACHINIST.

Draftsman, mechanical, for New York, wants position. Box 162, AMER. MACHINIST.

Experienced draftsman is open for engagement about September 1. Box 160, AM. MACH.

Position, by young mechanical draftsman, with 5 years' shop experience and university experience. Address Box 140, AMER. MACH.

Wanted—Position on turret-lathe work; thoroughly familiar in all its branches; capable of taking charge. Box 154, AMERICAN MACHINIST.

Draftsman, designer, technical graduate, 12 years' experience special machinery, 5 on shoe machines, desires change. "Swede 36," care AMERICAN MACHINIST.

Wanted—A position as assistant layer-out, boiler maker or sheet-iron worker, by a steady, sober man; repair shop preferred. "Reliable," AMERICAN MACHINIST.

Situation as foundry foreman; 16 years' experience as foreman engine work, general jobbing and machinery; member of American Foundrymen's Association. Tubal Cain, care AMERICAN MACHINIST.

Technical graduate, speaking English and French, writing shorthand, experience at drafting, desires position as representative or assistant at Paris Exposition. Address Box 153, AMERICAN MACHINIST.

I don't know it all, but 18 years in machine shop, pattern shop and drafting room have taught me that there are others. If you want a superintendent, write to me. Box 155, AMERICAN MACHINIST.

Responsible position, by mechanical engineer; 13 years' experience in shop and office; college education; good address; can handle men and hustle work; marine and hoisting machinery; highest references. Address Box 164, AMERICAN MACHINIST.

Mechanical engineer, technical graduate, with 3 years' practical experience and 3 years as assistant examiner in the Patent Office, metal-working division, desires position with large machine works or manufactory, to handle their patent work, develop improvements, etc. Box 156, AMER. MACH.

An experienced, middle-aged mechanical engineer, recently returned from Europe, seeks position of master mechanic or works manager; large and varied practice in machinery and up-to-date shop methods; expert draftsman; good executive and business ability and correspondent; excellent testimonials. Address Box 144, AMERICAN MACHINIST.

Mechanical engineer, graduate, experience 15 years, high-grade ability as designer and executive, advanced methods for duplication of interchangeable parts, thorough knowledge of textile machinery, including operating experience, wishes position as superintendent or head draftsman with large concern. Box 158, AMERICAN MACHINIST.

Help Wanted.

Patternmakers wanted; $3 per day. McLauthlin Co., Fulton st., Boston, Mass.

Draftsmen wanted, to design small tools, jigs, fixtures, etc. Address Box 168, AMERICAN MACHINIST.

A draftsman for work on electrical instruments and small special tools. Box 152, AMERICAN MACHINIST.

Wanted—First-class die-sinker. Only expert need apply, giving references and experience, to The Standard R. R. Signal Co., Troy, N. Y.

Wanted—Mechanical draftsmen; men familiar with electrical machines preferred; steady work for good men. Apply 42 Centre st., Lynn, Mass.

First-class engineer, familiar with the manufacture of duplicate parts and competent to act as inspector. Address Box 167, AMERICAN MACHINIST.

Wanted—Two first-class flat die makers and two round die makers. Apply to The Despatch Brass Hardware & Rolling Mill Co., Despatch, Monroe Co., N. Y.

Wanted—Intelligent machinist, used to machine-tool work, as instructor in machine shop of technical school in Middle West. Address, with particulars, Box 134, AM. MACH.

Wanted—A bright and active young man, with some mechanical knowledge, to act as receiver and inspector for firm near New York. Address Box 165, AMER. MACHINIST.

Wanted—Foreman for core department, malleable-iron foundry; 70 hands employed; must be practical and have good executive ability. Address Box 151, AMER. MACHINIST.

Wanted, in Connecticut, three or four hustling machinists, used to best modern methods; good pay; steady work; none but A1 men need apply. Box 163, AMER. MACH.

Wanted—A competent and up-to-date foreman who has had experience in building presses and special machinery; state reference, age and wages desired. Box 150, AMERICAN MACHINIST.

Wanted—Superintendent for large jobbing brass foundry making large and small castings; must be able to handle men and metal economically; give experience. Address Box 166, AMERICAN MACHINIST.

Wanted—Several first-class machinists; men with experience in building special automatic machinery for small wood and metal articles preferred; state experience and wages expected. Address Box 159, AM. MACHINIST.

Competent machinist as assistant superintendent in a factory near Philadelphia, to oversee tool-makers and make estimates on light contract work; state age, experience, references and wages required. Box 157, AMERICAN MACHINIST.

A good foundryman with a few thousand dollars can join a new engine company in the South at a fair salary, and good prospects for fair profit. Address, with references and wages wanted, "Engines," 187 Lewis st., Chicago, Ill.

Draftsman wanted; should be technically

(*Continued on page 40.*)

(*Continued from page 38.*)

sembled or set up in this country, and in this condition pay duty according to the rate pertaining to the chief material of composition—that is, greatest aggregate weight in the entire machine, as above explained: Flouring-mill machinery, electrical, cotton-spinning and weaving, steam engines and boilers, paper-mill equipments, machine tools, turbines, woolen spinning and weaving, pumps, ventilators, blowing machinery, steam hammers and rollers, shearing, punching and boring machines, etc.

Personal.

W. Sangster has been appointed superintendent at the works of the Boston Blower Company, at Hyde Park, Mass.

Mr. Franklin Williams has been appointed assistant to the general manager of the Eastwood Wire Manufacturing Company, of Belleville, N. J.

Chas. L. Bauer has been appointed general manager of the Warder, Bushnell & Glessner Company, Springfield, Ohio, to succeed his father, Charles A. Bauer, who died June 12.

Mr. Adolphe Janssens, of Paris, sailed Saturday, the 29th, by the "Lucania," for home, after having spent about two months in this country, looking about machine shops and placing orders for machine tools to be shipped to France.

We understand that the committee on nominations of the American Society of Mechanical Engineers had informally chosen the late Charles A. Bauer, of Springfield, Ohio, as a candidate for vice-president of the society. This, of course, would have been equivalent to election to that office had Mr. Bauer lived.

C. W. Burton, Griffiths & Co., of London, who make a specialty of handling American machinery, especially machine-tools, announce that they have opened a new depot in Glasgow, at 9 York street, where they will carry a full line of their specialties in metal and wood-working machinery, engineers' tools, etc.

John Ethier, a blacksmith, of Keene, N. H., has devised a method of hardening tool-steel articles which entirely prevents them from oxidizing or being discolored. He does this without special appliances, and in much the same way that hardening is ordinarily done, except that he applies to the work something which prevents oxidation, and the articles come out bright and clean as well as hard. Applying this method to bicycle ball cups, for instance, these not only come through the hardening bright and scaleless, but breakages have been reduced in one case from 20 per cent. to about 2 per cent., and the process, judged from samples of the work we have seen, is equally well adapted to taps and other cutting tools.

Manufacturers.

Work will soon begin on the new factory for the Pontiac Axle Factory, Pontiac, Mich., which will be 200x52 feet.

Work has been commenced on the power-house of the Rapid Railway at New Baltimore, Mich. A. J. Duprey, of Detroit, has the contract.

The Potomac Electric Light & Power Company, of Washington, D. C., has purchased more land, on which an addition will be made to the plant.

The Scoville & Peck Company, coach lamp makers, of New Haven, Conn., will erect a new factory on Wooster street, that city. They have a new lamp for burning acetylene gas.

Architect William A. Shaw is working upon drawings for the erection of a new factory building in Bristol street, Philadelphia, Pa., for the Moore Safety Valve Company. It will be of brick and iron, four stories in hight, 55 by 120 feet.

The S. M. York Company, of Cleveland, has been incorporated at Columbus, O., to deal in machinery and supplies. Capital stock, $50,000. The incorporators are Daniel Bigley, Charles N. Hess, Jessie I. Hess, J. F. Harper and Sheldon Parks.

The Wyoming Valley Lace Manufacturing Company is making extensive improvements to its plant on Union street, Wilkesbarre, Pa. The present structure on the north side of the street is being enlarged to meet the demands of the additional machinery.

J. C. Dunn, of Camden, N. J., has taken title to a large tract of land in South Camden from the Manufacturers' Land & Improvement Company. It was stated that a plant for the manufacture of oil cloth and linoleum would be erected on the grounds.

The Frank Mossberg Company, of Attleboro, Mass., is erecting a factory which will give a floor space of over 20,000 square feet. It is expected to have this completed by October 1. New machine tools, presses and polishing and grinding machinery are to be installed.

The contracts for the buildings and grading for the Logan Manufacturing Company's plant to be established at Phoenixville, Pa., were recently let. The main building will be erected by the Phoenix Iron Company. The Logan Company will manufacture steel and iron on an extensive scale.

Just as soon as they can determine where to locate it the Stover Manufacturing Company, of Freeport, Ill., will begin the erection of a plant costing about $75,000 and covering five acres of ground. This plant will be devoted to the manufacture of farm machinery, and the company's plant in East Freeport will be devoted to the manufacture of hardware articles.

The Equitable Autotruck & Power Company has purchased a tract of land containing about an acre, adjoining the Boston & Maine Railroad at West Lynn, Mass. On the land is a three-story manufacturing building, 200x64 feet. Three other buildings will be erected there in the near future, the contract for one having already been let. The company will manufacture automobiles of the various styles, using steam for power.

It has been reported that the Christensen Engineering Company, Milwaukee, Wis., was having plans drawn for a $60,000 electrical machinery factory, and that three sites on the south side were being considered as a location for the plant. N. A. Christensen, a member of the company, said that the building of such a plant was being arranged for, but that the plans were not completed, and

(*Continued on page* 41.)

Help Wanted—Continued.

proficient, ambitious, and with at least 2 years' practical drafting-room experience; line, high-class automatic, sheet-metal and wire-working machinery. Address "Permanent," care AMERICAN MACHINIST.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite applications from draftsmen, pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

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Wanted—A thoroughly experienced man, capable of taking the superintendency of an agricultural implement factory; must be of good character and habits, a first-class mechanic and organizer, well recommended. Address, giving full information as to above requirements, giving age and stating whether married or single, Lock Box 309, Jackson, Mich.

Wanted — Several first-class machinists, also a number of young men and boys who have had some experience in machine shops, by a concern manufacturing high-grade machinery, located near Chicago; shop is new and strictly up to date; steady work and good opportunities for the right kind of men. Write, stating age, experience, wages expected, to Box 149, AMERICAN MACHINIST.

Wanted—A gentleman thoroughly acquainted with the development and present condition of the motor-vehicle industry, capable of conducting or assisting in the conduct of a motor-vehicle department in a well-known trade journal; the successful applicant must be a man of considerable ability, originality and a good writer; as full particulars as possible by first letter will facilitate matters. Address Frank Morice, 5524 Madison ave., Chicago.

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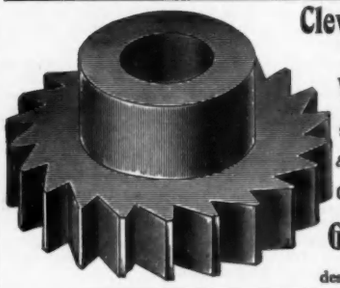

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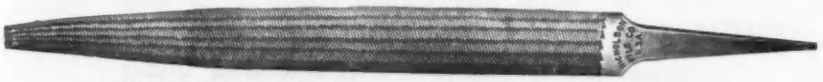

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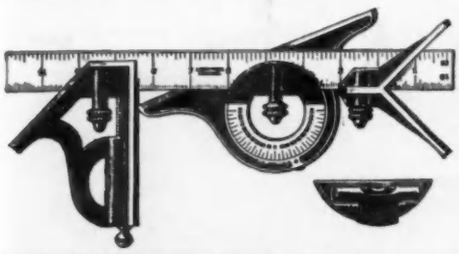

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Catalog sent on application.

(*Continued from page* 40.)

that he was not prepared to give any particulars as to the location.

The Monongahela Light & Power Company has begun the erection of its new powerhouse at the Rankin end of the West Braddock bridge, Pa. The house will cost, when completed, about $1,500,000. The building will be 200 by 350 feet. It will be equipped with machinery of the Westinghouse type, and when completed and in operation will furnish power and light for the Monongahela Street Railway, the city of McKeesport and the boroughs of Homestead, Braddock, Wilkinsburg, Swissvale, Rankin, North Braddock, Duquesne, Turtle Creek, Wilmerding and East Pittsburgh.

New Catalogs.

W. S. Rockwell & Co., New York, send us catalog of annealing and hardening furnaces for oil or gas. These furnaces are of various sizes. The catalog is 8x10 inches.

We have received copy of small pamphlet from S. M. York & Co., Cleveland, O., describing power presses. The various points of interest regarding these presses are referred to, and prices are also included.

We have received from the Pearson Machine Company, Chicago, Ill., catalog of machine tools and automatic machinery, including screw machines, turret lathes, hub machines, facing machines. Details of construction of the various tools are given. The catalog is 4x6 inches.

We have received from the Hadaway Electric Heating & Engineering Company, New York, a catalog illustrating and describing electric heating machinery used in hat manufacture. Inside views of hat factories, showing these appliances at work, are given. The catalog is 6½x9 inches.

A. L. Ide & Sons, Springfield, Ill., send us catalog of the "Ideal" automatic cut-off steam engines. The various features of these engines are minutely described, the catalog containing numerous illustrations of engine parts. The catalog is nicely gotten up and is standard size, 6x9 inches.

From Henry R. Worthington, New York, we have received pamphlet containing descriptions and illustrations of condensing apparatus recently installed by the company referred to. The pamphlet is attractively gotten up, and those interested in this class of machinery will find in it much to interest them. It is 6½x8½ inches.

The Wyoming Engineering Company, Pittston, Pa., sends us small book entitled "A Few Plain Facts," the purpose of which is to set forth a few facts regarding the steam eliminators made by the concern. Some interesting tables for pipe dimensions, air spaces between grate bars, etc., are given. The catalog is 5¾x6½ inches.

From the Bullock Electric Manufacturing Company, Cincinnati, catalog illustrating and describing the line of electric generators, motors, showing their application to the driving of printing presses, lathes, planers and other machine tools. The various motors illustrated are described in careful detail. The catalog is standard size, 6x9 inches.

We have received copy of the Year Book of the Armour Institute of Technology, Chicago, for the season 1898-1899. A brief history of the founding and development of the institute is given. In the technical department courses in the following subjects are conducted: Mechanical engineering, electrical engineering, architecture, science and civil engineering. All necessary information concerning location of buildings, expenses, available scholarships, degrees, etc., is to be found in the catalog.

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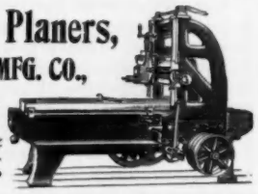

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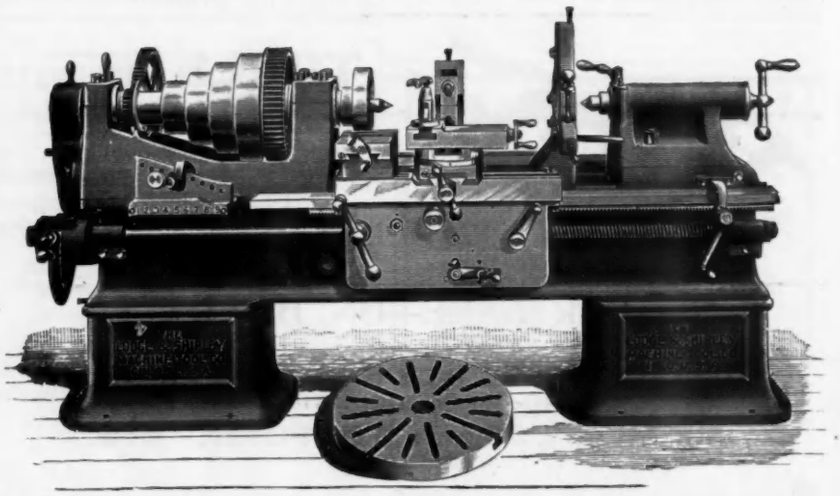

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